The Chemical Age

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Notes and Comments

Overseas Chemical Trade

THE Board of Trade returns for April, a summary of which appears in another page, serve to show the trend of the chemical industry immediately before and immediately after the coming into operation of the Import Duties Act. To examine the figures in their proper perspective it is necessary to compare them with some of the months preceding the change in Britain's tariff policy. In January we reported that, according to the December returns, exports of chemicals, drugs, dyes and colours were lower by £196,865 than in the corresponding month of 1930, imports were higher by £75,721 and re-exports higher by £176,993. Setting off the increased imports against decreased exports, and omitting re-exports, the net effect of the returns was to reveal an adverse movement to the extent of £272,586. In January there was a decrease of £277,040 in exports compared with the same month of 1931. Imports were also lower by £170,015 and re-exports declined by £2,299. Balancing imports against exports in the same way, there was a net advantage of £107,025. February brought a welcome increase of £105,011 in the value of chemical exports, but there was also a rise of £588,076 in imports, with an increase of £83,422 in re-exports, the excess of imports increase leaving a net adverse balance of £483,065.

In March, the first month of the operation of the new tariffs, exports showed an increase of £148,241 while imports fell by £328,050, re-exports increasing by £5,096. The combined effect of the rise in exports and fall in imports was an advantage of £476,291 in favour of British chemical interests. Exports in April showed a slight rise of £35,144, but imports for the same period fell by more than 50 per cent. from £1,142,186 to £567,793, the net effect being a favourable balance of £609,537.

Fresh Knowledge on the Vitamins

A FEW years back nothing was known of the chemical properties of the vitamins. Their existence was determined by experiments carried out on animals and by biological tests, the presence of these peculiar bodies in any substance being discovered by the efficiency with which diets containing the substance prevented diseases such as rickets or scurvy. During the last eighteen months, however, chemical tests have been established, and one or more of the vitamins have actually been prepared in pure crystalline form. Vitamin D is now manufactured by the irradiation of ergosterol, and has been placed on the market under the name of "Calciferol", reference having been made to this development in previous issues of THE CHEMICAL AGE. Crystals which are thought to be nearly pure vitamin B have been obtained from natural sources by two Dutch chemists; vitamin A is claimed to have been synthesized in Norway, and a Hungarian scientist has put forward the suggestion that vitamin C is identical with hexuronic acid, an alternative view being that this particular vitamin is formed by the action of light upon narcotine. These unexpected results have now been supplemented by researches carried out in the Department of Physical Chemistry at Cambridge, where Dr. F. P. Bowden and Dr. C. P. Snow are investigating the internal structure of the actual vitamin molecules. The technique which these two scientists are employing is a development of photochemical and spectroscopic methods. When the molecules of any substance are sufficiently excited or agitated they vibrate and emit rays of light. If they are raised to the temperature of several hundred degrees centigrade they become red-hot and emit red light; at still higher temperatures they emit white light. Just as agitated molecules tend to emit rays characteristic of themselves they also tend to absorb these characteristic rays if allowed to fall on them. Something of the structure of a molecule of any substance can therefore be observed from the nature or colour of the light which it absorbs when illuminated by light from a particular source. From the information obtained it has been concluded that the internal structure of the vitamin molecules is more or less controlled by light of some particular wave length. The effects of this selectiveness should ultimately prove to be of great importance in future attempts at synthesis, for if the parent substance is irradiated with light comprising rays of varied wave lengths, some of the rays may have a tendency to counteract the influence of the remainder and thus reduced the efficiency of the transformation. For instance, in the production of vitamin D by the irradiation of ergosteral it has hitherto been usual to employ a beam of mixed rays, some of which have possibly decomposed a proportion of the vitamin as soon as it has been formed by other rays in the beam.

Chemical Warfare

WHILST every peace-loving citizen must be in complete agreement with the sentiment expressed by Mr A. J. Gillian, secretary of the Chemical Workers' Union, in his pamphlet on "The Menace of Chemical Warfare to Civilian Populations" (reviewed in these

columns recently, there will not, we imagine, be such unanimous support for the manner in which he has presented the case, which gives one the impression that bombardment by high explosive is a much more acceptable method of attack for the civil population than is poison gas. With this view the great majority of people will disagree. Both methods are terrible, and the prospects in any war with a near Continental power are awful to contemplate. The pamphlet puts matters in such a wrong perspective that it is likely to do as much harm as it does good.

Readers of the pamphlet will have observed that Mr. Gillian makes no practical suggestion as to how war may be prevented, and as long as we must maintain armies, navies and air forces for the protection of the country we must similarly take steps to protect the civil population in the event of their being attacked by high explosive or gas from the air. Government committees have been hard at work on such schemes for the past ten years, and we understand that an official volume on the subject of defence against gas will shortly be published. It will be issued in the first instance to the police, local authorities, St. John's Ambulance and other bodies likely to play an important part in the scheme of defence. Subsequently it will be made available to the civil population at large, but such instruction and propaganda must be done with great care, otherwise it may fail to achieve the object desired, namely, the security of the civil population in the event of this country being attacked.

The German Dye Trust

A REDUCTION in capital by the cancellation of 110,000,000 Rm. (£5,500,000) of management shares was approved at the annual meeting of the I. G. Farbenindustrie A. G. (the German Dye Trust) held at Frankfurt on May 10, and the shareholders approved the distribution of a dividend of 7 per cent. for the financial year 1931, against 12 per cent. for the preceding year. The outstanding ordinary share capital, entitled to the dividend, now amounts to 685,000,000 Rm. (£34,250,000) nominal. In the course of the general discussions Geheimrat Bosch, who has just returned from a journey abroad, pointed out that the impossible position of the reparations problem continued to constitute the main cause of the international economic breakdown and of the general uncertainty and lack of confidence. Without a permanent and final solution of the question of reparations and international debts the creation of a new credit basis was impossible. The collapse in international economics, he continued, demanded that steps must be taken without delay for relieving the common distress, and that all international problems must be solved together and definitely. German economy could not be blamed for adopting counter-measures against the abnormal and confused trade policies of aggression, which were hitting German exports everywhere. Germany had the earnest desire to pay her private debts, but, in the opinion of international science and practice, she could only do so by way of export surpluses, and her goodwill was being impeded by the protectionist policies of the creditor nations. Geheimrat Bosch emphasised his former statement that it would be erroneous in principle for Germany to resort to counter-measures with the view to separating her economy from that of the rest of the world. The principal aims of any future international conference, he declared, should consist of a cancellation of all political debts, removal of Customs barriers, and reconstruction of trade relations in mutual confidence and by mutual understanding.

Liquid Assets

THERE has been no deterioration in the liquidity of the German Dye Trust concern as a consequence of the reduction of share capital. In supplement of the report, it was stated that liquid assets now amounted to about 120,000,000 Rm. (£6,000,000) against 93,810,000 Rm. (£4,690,500) at the close of last year. Losses on foreign exchange had remained below 10,000,000 Rm. (£500,000), which should be considered in relation to the big turnover of the company. No losses had been suffered on credit balances through the depreciation of sterling, as the holdings in sterling had been disposed of four weeks before England left the gold standard. Business developments during the first quarter of the new year were adversely affected by the continuous economic crisis, and exports underwent a further decrease. While sales of dyes and auxiliary products had been satisfactory, sales of chemicals were smaller than in the preceding quarter. Trade in pharmaceuticals was particularly impeded by the new foreign import quotas and foreign exchange restrictions. Prospects in this branch were not favourable at present. The turnover in photographic goods had receded, and rayon prices had declined further. Sales of synthetic nitrogen, both at home and abroad, had fallen by about a further 20 per cent. during the first quarter of this year in comparison with the average for 1931. The production of synthetic petrol at the Leuna Works had to be restricted at the end of February owing to a fire at the Volkenroda plant. In the German motor spirit market there was a keen competition from the foreign oil importing companies. In order to avoid the dismissal of hands a 40-hour week had been introduced at the German Dye Trust's works at Oppau and Merseburg on January 1 last.

The Tin Restriction Plan

THE Council of the Tin Producers' Association, being of the opinion that the additional cut of 20,000 tons in the international quota coming into force on June 1 is inadequate to effect its object, has now by unanimous resolution at a recent meeting endorsed a recommendation for the reduction of the international quota of 162,168 tons, allotted to the four signatory countries, to 33⅓ per cent., or 54,056 tons, taking effect as from June 1 and subject to quarterly control. It is also provided that no tin shall be exported by the signatory countries during the months of June and July, whilst quantities released during the succeeding ten months shall be in such proportion that the rate of total exports beginning in August 1932 shall not exceed 5,406 tons per month. Tin, rubber and other natural products are all involved in this wave of restriction proposals, but little attention is as yet being given to the possible ill-effects of the over-production of heavy chemicals by synthetic methods which have been and are still being introduced in all chemical manufacturing countries.

Special Reagents in Analytical Routine

The Estimation of Small Quantities

THE following article is based on information supplied by The General Chemical and Pharmaceutical Co., Ltd., of Judex Works, Sudbury, Middlesex, who have done much pioneer work in regard to special reagents for the detection and estimation of small quantities of metals and acid radicles. The optimum conditions which appertain to the use of these special reagents, together with data on conditions and dilutions, are set out in a series of leaflets which this firm has published as and when new reagents have been introduced.

A COMPARISON of the industrial methods of to-day with those of a decade ago will reveal alterations in many directions, and it is probable that the most outstanding change lies in the different degree of emphasis placed on the presence or absence of small percentages of substances, the presence of which may be either desirable or undesirable. This emphasis has largely been removed from the 99 or 99.9 per cent. repre senting the bulk material, and transferred to the actual components of the remaining 1 or 0.1 per cent. of impurity present. Some examples of this changed emphasis might be quoted. For instance, in many new alloys which contain comparatively small proportions of one or more of the alloying metals we find that it is these small additions giving the alloy some very desirable property. The importance of small quantities is still better emphasised in catalytic processes, where a mere thimbleful of some new impurity in a batch of material, will quickly "poison" the catalyst and render it ineffective. Such happenings bring from the chemist-in-charge a definite demand for some means of reducing the time spent on routine testing, and in keeping track of losses of valuable catalyst, or, more frequently, in detecting the presence of catalyst poisons in the raw materials, and their accumulation in liquors which are returned to the process.

The dilutions concerned in these cases are so great that ordinary methods of separation have to be preceded by periods of tedious concentration, which involve the introduction of indeterminable errors; further, the amounts of material separated are often so minute that identification and estimation almost become more related to chance than to scientific precision. Where high dilutions are involved, a number of special reagents have therefore been devised, the use of which depends on characteristic reactions, precipitates or colour changes, which are specific, or nearly so, to certain ions. In making these reagents commercially available in this country, much pioneer work has been done by The General Chemical and Pharmaceutical Co., Ltd., who initiated this policy with the introduction of "Magneson" in 1927.

Detection of Magnesium and Aluminium

The detection of small quantities of magnesium has always been a tedious operation, especially when considerable quantities of alkaline-earth metals are present. The introduction of "Magneson," which will detect small quantities of magnesium in the presence of relatively large amounts of these other metals has been well received. This reagent is used as a 0.5 per cent. solution in 1 per cent. sodium hydroxide, the colour of which is a deep reddish violet; the addition of a few drops of this solution to one containing magnesium produces immediately a sky-blue colouration, or at higher magnesium concentrations a deep blue flocculent precipitate. The blue compound is destroyed by even weak acids. Nickel and cobalt yield similar blue compounds, but if the heavy metals are first removed as sulphides the reaction is characteristic of magnesium. The sensitivity of the test, which is of the order of 0.002 mg. of magnesium, is markedly decreased by the presence of ammonium salts, which should therefore be removed before the test is applied.

"Aluminon," another special reagent, will detect as little as 10^{-6} mol of aluminium, and it is only necessary to mention the widespread use of aluminium and its alloys in the construction of chemical plant, especially for use in the preparation of foodstuffs and materials for incorporation in foodstuffs, to show the value of such a reagent. The use of "Aluminon" for the detection of aluminium depends upon the production, in acetic acid solution, of a red lake which is not decomposed on addition of ammonium hydroxide solution containing carbonate; chromium salts form a similar lake which is decolourised by ammonia whilst large quantities of alkaline earth metals salts produce red precipitates, which are decolourised by the carbonate ion. Ferric iron, in acetic acid solution, forms a deep violet precipitate, which on treatment with ammonia turns to a reddish-brown, but the usual separation of iron and aluminium with sodium hydroxide permits the use of "Aluminon" for the detection of the latter metal.

Reagents for Quantitative Work

Ortho- or 8-hydroxy-quinoline is a reagent of a different kind from the foregoing. Its properties are not sufficiently specific to any one metal to make it useful for the detection of small quantities, but it offers considerable advantages when used for estimating small quantities, *e.g.*, of aluminium, zinc or magnesium. For aluminium, a faintly acid solution containing sodium acetate, treated with excess of the reagent solution gives a precipitate which on drying to constant weight at 110° contains 5.87 per cent. of aluminium; or the estimation may be made volumetric by dissolution of the precipitate in 10-15 per cent. hydrochloric acid and titration with 1/10 N. bromate-bromide solution. Zinc and magnesium may be determined in the same manner. If both are present simultaneously, the zinc should first be precipitated by ortho-hydroxy-quinoline from dilute acetic acid solution, and the magnesium by ammonium hydroxide in the filtrate. By slight modification of the method, separation of aluminium and magnesium when present in widely varying proportions may be effected.

α-Benzoin-monoxime is employed in the detection and determination of copper, in presence of all other metals. A slight excess of an alcoholic solution of this reagent, added to an ammoniacal solution of a copper salt, precipitates the whole of the copper even at a dilution of 1 in 33,000, while by means of the drop-reaction on filter paper the sensitivity may be raised to 1 in 500,000. The green precipitate is insoluble in water, dilute ammonia, alcohol, acetic and tartaric acids, but is soluble in mineral acids and to a slight extent in concentrated ammonia; the method can thus be used in ammoniacal solution to which tartaric acid has been added for the purpose of keeping iron in solution. For quantitative work the precipitate is collected on a Gooch crucible, washed with a little hot 1 per cent. ammonia and then with water. After drying at 105-110° C. the precipitate is washed, first with alcohol and then with water to ensure removal of any excess reagent, and dried to constant weight. The percentage of copper in the precipitate is 22.02.

Estimation of Nickel in presence of Cobalt

α-Benzildioxime is used for the determination of nickel, particularly in the presence of a comparatively large amount of cobalt. This reagent possesses advantages over the older reagent, dimethylgloxime, in sensitivity, as one part of nickel per million, in the presence of one hundred times the quantity of cobalt, gives an immediate precipitate, whereas dimethylglyoxime yields no precipitate even after three days. The reagent is used in the form of a 0.2 per cent solution in alcohol, containing 5 per cent. of dilute ammonia. After filtering through a Gooch crucible, washing with alcohol (50 per cent.) and water and drying at 110° C., the precipitate contains 10.93 per cent. of nickel. The solution of nickel should not contain nitrates. The cobalt salt is formed but is soluble; an excess of reagent must therefore be used. Iron may be kept in solution by Rochelle salt, zinc and aluminium by ammonium chloride, whilst in presence of chromium, tartaric acid should be present. If manganese be present an excess of reagent should be used, and the precipitation carried out in dilute acetic acid solution.

The use of α-nitroso-β-naphthol is complementary to that of α-benzildioxime in that it is of special value for the determination of cobalt in the presence of nickel, as well as providing a means for determining palladium. It is prepared for use by dissolving 0.1 gram of α-nitroso-β-naphthol in 20 cc. of water containing 1 cc. of dilute caustic soda

solution, filtering and diluting to 200 cc. To test for cobalt 1 cc. of ammonium chloride solution and 1 cc. of the reagent are added to the neutral or slightly alkaline solution. If cobalt is present an orange or claret colouration, or, at relatively high concentrations, a red precipitate, is produced; the colouration or precipitate remains unchanged on the addition of dilute sulphuric acid, whereas the colourations produced by nickel, iron, etc. are destroyed. Manganese and zinc do not interfere, but large quantities of nickel affect the colouration; most of the nickel should, therefore, be removed by use of dimethylglyoxime or α-benzildioxime. The limit of sensitivity is 1 part of cobalt in 100,000 of water, so that this method of colourimetric comparison may be used for low cobalt concentrations. With palladium, the bulky precipitate is reduced to spongy palladium, by incineration with oxalic acid, and weighed as such.

Estimation of Alkali Metals

The availability of two reagents, one giving a soluble potassium but an insoluble sodium salt, and the other a soluble sodium but insoluble potassium salt, means a considerable saving in time when it is necessary to estimate repeatedly the concentrations of the two metals in a series of solutions of similar composition. Dihydroxytartaric acid and 5-nitro-6-chloro-toluene-3-sulphonic acid (sodium salt) are two reagents which comply with these requirements, their value being enhanced by the fact that both give soluble magnesium salts.

To a cold solution, which should contain neither borate nor any metals other than sodium, potassium or magnesium, present preferably as chloride, nitrate or sulphate, a slight excess of an approximately 3 per cent. solution of dihydroxytartaric acid is added. After standing for half an hour, the precipitate is filtered off and, after washing three or four times with 4-5 cc. of ice-cold water, is dissolved in dilute sulphuric acid and titrated with standard potassium permanganate. The results of the determination are consistent to within 0.1 per cent. To effect the complementary potassium precipitation, an excess of a 5 per cent. aqueous solution of the sodium salt of the substituted toluene-sulphonic acid is added to a similar solution, when the presence of 2 mg., or even less, of potassium in 5 cc. of solution will cause the appearance of glistening plates of the potassium salt. The use of these two reagents for sodium and potassium respectively obviates the necessity for previously removing magnesium with the inherent tedious blank determination.

Allyl-iodide-hexamine, one of the latest additions to the range of Judex special reagents, is a valuable means for the determination of cadmium. The isolation of cadmium as sulphide has always been a tedious procedure owing to the difficulty of washing the finely divided precipitate free from soluble impurities and the necessity of converting the sulphide to some other salt before weighing. Allyl-iodide-hexamine in 1 per cent. aqueous solution added to a neutral solution of cadmium precipitates the whole of the cadmium in a heavy granular or crystalline condition. This precipitate, which is slightly soluble in water but quite insoluble in the presence of an excess of the reagent, is filtered off, washed with alcohol (96 per cent), and dried to constant weight at 100° C., at which temperature it is quite stable. The cadmium content of the precipitate is only 11.44 per cent. Zinc, even in large excess, does not interfere with the quantitative exactness of this reaction.

Electro-Deposited Nickel

The Adhesion of Deposits on Brass

THE nature and degree of adhesion of electro-deposited nickel obtainable to brass surfaces cleaned by methods not involving etching have recently been studied by A. W. Hothersall, of the Research Department, Woolwich, and the results of this research were incorporated in a paper read before the Electro-platers' and Depositors' Technical Society, at its meeting in London, on May 18. The degree of adhesion has been found to vary according to the nature of the brass surface. Thus, whilst a relatively high adhesion was obtained to filed or machined brass, only a slight degree of adhesion (such that the deposit could be pulled off with the fingers) was found in the case of emeried brass. The results obtained by the tests applied do not, however, indicate the true adhesion as the test pieces invariably failed in the surface layers of the brass and not at the deposit-brass interface. In the majority of cases, heat treatment of nickel-coated specimens at 250° C. for two hours was found to improve very considerably the degree of adhesion of nickel deposits to surfaces not subjected to etching during cleaning, and a similar improvement in adhesion was generally obtained by the preliminary deposition of a layer of copper from the acid sulphate solution followed by deposition of nickel. By these methods fairly strongly adherent deposits could be formed on emeried brass, and with their use the effect of progressive etching of an emeried surface was studied. The degree of adhesion was found to increase gradually with the degree of etching, and it is concluded from this and from the results referred to above that the poor adhesion of electro-deposited nickel which is obtained on unetched emeried brass is due partly to embrittlement of the surface layers by absorption of hydrogen and partly to the inherently weak condition produced by the emery treatment.

Suitable Methods of Etching

In the case of buffed brass, it has been found that the material which is particularly weak inherently, and which is principally susceptible to hydrogen embrittlement, is confined to an extremely thin surface skin, probably less than 0.0005 mm. in thickness, and that removal of this skin by means of suitable etching treatment before deposition of nickel results in the production of adherent deposits. Etching by means of nitric acid or mixtures containing nitric acid has been found to be undesirable, as the process cannot be satisfactorily controlled. Anodic etching in a suitable solution, however, affords a means whereby polished brass surfaces may be sufficiently etched to ensure the production of adherent nickel deposits without noticeably dimming the lustre. Two solutions were used for the anodic etching of brass—a potassium cyanide solution, and a solution containing citric acid and ammonium citrate. Treatment of buffed brass at 10 amps. per sq. ft. for about half a minute has been found to be sufficient to ensure the production of highly adherent nickel deposits on a number of different types of brass without appreciably affecting the polished appearance.

Difficulties of Obtaining Good Adhesion

The difficulties of obtaining good adhesion of nickel to brass in decorative plating are principally connected with the necessity for preserving the polish of the brass, since it is known that by the use of suitable etching methods, which cause a pronounced roughening of the surface, adherent coatings having a degree of adhesion which is, in general, approximately equal to the shear strength of the basis metal can readily be produced. If, however, the smooth finish of the brass is materially destroyed, heavy polishing is necessary subsequent to nickel plating, and unless nickel deposits of a greater thickness than is normally considered necessary are applied, there is considerable risk of laying bare the brass at exposed areas, such as projections and edges, and in any case the deposit is liable to be rendered very thin in such areas, and its protective power consequently considerably reduced. High finishing costs and reduction of protective properties thus prevent the general adoption of drastic etching methods in decorative plating. The work described was undertaken with the object of determining the more important causes of poor adhesion of nickel electro-deposited on brass for decorative purposes, and was carried out with the aid of funds provided by the British Non-Ferrous Metals Research Association. Problems connected with the preliminary operation of removing grease from metal surfaces have been considerably studied in recent years, and were not included in the present investigation.

The Paint Industry of the Future

Annual Meeting of the Oil and Colour Chemists' Association

THE annual general meeting of the Oil and Colour Chemists' Association was held at the Institute of Chemistry, 30 Russell Square, London, on May 12, under the chairmanship of Mr. Noel Heaton, retiring president. Presenting the annual report of the Council, the president said it was satisfactory that the membership showed a slight increase despite a careful revision by the Council and the removal of a number of members whose subscriptions had not been paid for some years.

The Council nominated the following and they were duly elected: President, Mr. J. A. F. Wilkinson; vice-presidents, T. H. Barry, S. A. Bone, A. A. Drummond, N. Heaton and T. F. Spence; hon. secretary, Mr. Forrest Scott; hon. treasurer, Mr. M. E. Dougherty; hon. editor, G. Copping. As the result of a ballot, the following members of Council were elected to fill vacancies: Mr. S. G. Clifford, Dr. J. O. Cutter, Mr. W. Garvie and Mr. D. Wait.

Votes of thanks were passed to the retiring president, the retiring members of Council and the hon. officers for their work during the past year.

MR. NOEL HEATON, in vacating the chair in favour of Mr. Wilkinson, said it would be impossible for any president to carry on the work of the Association efficiently without the hearty support of the Council and officers, and this he had had in full measure. He stressed the work done by Mr. Drummond in editing the Journal, and said Mr. Drummond desired to retire last year but agreed to carry on the work until a suitable successor was found. He also paid a tribute to the work of Mr. Aitken, the general secretary, and regretted that he himself had not been able to do much that he had planned to do when he first took office. Unforeseen responsibilities, however, had been placed on his shoulders which had prevented him devoting as much time as he had hoped to the affairs of the Association but he could only hope that the members would take the will for the deed and believe that he had really done all that he could. He wished Mr. Wilkinson a successful year of office and the same willing co-operation on the part of the members of the Council and others that he himself had received.

MR. WILKINSON then took the chair.

Changes in the Next Fifty Years

Mr. R. G. DANIELS, presenting his paper on "The Paint Industry of the Future," said there had been such great advances in all branches of the trade during the past ten years that it was only logical to assume that the next fifty years would see many more, and the diversity of possibilities of developments was almost bewildering. As regards new finishes, he assumed that paints would be used but in the main their function would be purely decorative and not, as at present, both decorative and protective. It was not unreasonable to suppose that fifty years hence there would be available metals with an almost indefinite resistance to corrosion, and also that there would by then be some method of treating wood which would also indefinitely prolong its life. Perhaps one exception would be the anti-fouling and anti-corrosive paints used on ships, but even in that direction what guarantee was there that some genius would not produce a rustless steel to which barnacles could not attach themselves? There was also the possibility of applying a current of electricity to the hull of a ship which would have the effect of resisting the chemical products produced by the electrolysis of sea water.

Assuming, then, that paints and varnishes would be used solely for decorative effects, what types of finishes were likely to prove popular? He fancied that matt or semi-matt finishes would be extremely popular as being far more restful to the eyes, and that colours would be either pale tints or deep restful shades. Bright reds would disappear, save for work where distinctive shade was desirable, such as danger signals, and pure white would be used solely for such purposes as sun reflection. White ceilings would disappear.

As the production of new materials was a slow process it was obvious that in 50 years many paints and varnishes would still be used on old buildings, bridges, ships and the like as 50 years was a comparatively short period in the life of a well built house and nothing in the life of a well built structure, but the amount of paints and varnishes used on new work, primarily for protective purposes, would be considerably reduced. The application of tinplate varnishes and lacquers, stoving blacks, insulating varnishes and toy finishes would not be much changed as their use was already mainly decorative, and where the object was protective, paint and varnish probably afforded the cheapest method of attaining such an end. On the industrial side, which at first sight appeared a stronghold, the trade was likely to be effected by improvements in the resistance of metals to attack, whilst the lacquers at present used for the inside of tinned food containers, would in all probability be rendered obsolete by the development of suitable materials.

Raw Materials

Speaking of raw materials, he suggested that linseed oil and tung oil would still be with us, but mutiliated beyond all recognition and used in ways at present totally unfamiliar. The natural resins would have practically disappeared from industry, and would be replaced by synthetic resins manufactured under strict control and consequently of a much more uniform character. The chief advance in pigments would be in their physical characteristics, *i.e.*, they would be delivered to the paint manufacture in a state of extremely fine sub-division and prepared in such a way that they would be wetted with the appropriate medium with the minimum amount of trouble and energy. White spirits, turpentine, and the thinners of the cellulose enamels would to a large extent be replaced by water, and aqueous emulsions would play a bigger and more important part in the industry than was at present realised. Quite 50 per cent., and probably a larger percentage, of the pigments now used were wet with water in the stage immediately before delivery to the consumer and the removal of this water constituted a considerable cost. That fact alone was sufficient to make the investigation of this problem worth while.

The brush would be practically ousted by the spray, and celloluse finishes in house decoration would be as widespread in fifty years as they were at present in the automobile industry. The two chief difficulties were the inflammable nature of the vapours given off when drying, and the decided residual odour, which at present could only be avoided by the use of the now unsatisfactory plasticisers. The first difficulty would be overcome by the use of aqueous emulsions, and the second by the development of more efficient plasticisers. In Mr. Daniels's opinion this important part of the cellulose lacquer had hardly been investigated at all.

The Question of Plant

How does all this affect the question of plant, asked Mr. Daniels? If aqueous emulsions, are used there would be nothing at all to prevent the purchase of pigments in pulp form and although there would be extra cost of carriage on the water, where the pigment is not made on site, this would easily be off-set by the fact that there would be no drying costs or final milling costs after drying. The plant in the paint factory proper will be radically different. Emulsifying machines will be the most important pieces of plant everywhere except in the varnish factory, which must turn into a chemical factory, and it is in this branch of the industry that the biggest changes are foreseen because it is one which is still more of an art than a science. Such machines as edge runners, cone mills, triple roller mills and the like will disappear, and all machinery will be of the high speed type. Problems of wetting of pigments, grinding and so on, will disappear from the paint factory and become the worry of the pigment manufacturer, who in all probability will have to produce each pigment in three varieties, one for oil, one for varnish and one for cellulose.

Dealing with specifications for paints, Mr. Daniels said this is often done in the most ludicrous manner. Specifications should be drawn up by experts only and where the specifier was not a paint expert he should get the opinion of somebody who is. Paint manufacturers have a legitimate grumble in regard to this matter, it was added. Referring

to the oil and colour chemist, Mr. Daniels suggested the need for a greater development of chemical knowledge; the greater part of their work at present consists in examining the physical properties of the raw materials. For instance, linseed oil, tung oil, etc., must be used as chemicals. Sometimes oil is used by itself, sometimes emulsified with aqueous colloid solutions such as casein or glue, and sometimes the composition and nature of the oil is altered by heat treatment and even a certain amount of chemical treatment, after which it is mixed with a resin, either natural or artificial. In any case, the oil is finally applied as a thin layer, absorbs oxygen from the air and forms a film, which continues to absorb oxygen and finally perishes. It was suggested that when the synthetic resin is made, the oil or the essential radicals of it, should be chemically combined in the resin so that when finally deposited on the surface, evaporation of one portion of the medium should leave a film of a satisfactory nature which is not liable to further alteration. It might be necessary before using the oil in such a way to satisfy some of the unsaturated linkages chemically, but that is a matter for research to determine. Such a quick drying vehicle, however, could only be satisfactorily applied by spray. Another direction for study is the influence of small quantities of impurities on film formations. Very few of the materials used even approximate to chemical purity but the effect of variations in the chemical composition of, say, pigments has not really been systematically studied and here again there is much work to be done in the future.

Points from the Discussion

The PRESIDENT said his own view was that the durability of the paint film must be considered apart from the decorative aspect. He imagined that non-corrodible metals would be considerably more expensive than paint for a considerable time and from that point of view the outlook for the paint industry was perhaps not so depressing as might be inferred from the paper. Stoving finishes had developed enormously recently and were increasing every day, very durable finishes being produced. Emulsions formed another problem of the future and, in his opinion, would develop for decorative purposes, but it was a little difficult to see how an aqeous emulsion would give any protection, if protection were still needed, in view of the somewhat large amount of water which such emulsions contained.

Mr. H. W. KEENAN said the suggestion of putting an electric current around a hull to prevent barnacles adhering had already been tried and the study of the problem of barnacles had been carried quite a long way. The problem, however, was largely a matter of bacterial agency rather than chemical action and from that point of view he believed compositions would always be required. As regards cellulose, he believed this would pass out of use long before the 50 years mentioned by the author. At the present time there were too many disadvantages to allow cellulose to go much further and finally we should probably come to some form of synthetic covering.

Mr. T. HEDLEY BARRY suggested that the new "Daily Express" building in Fleet Street went some way towards filling Mr. Daniels's prophecies for 50 years hence. Not only was there not a straight line in the building, but the walls and windows were perfectly flush, whilst the surface of the building was black glass. The tendency to-day was not so much to find a non-corrodible surface but to find a suitable lacquer to put on a surface. At the same time, a non-corrodible film produced by some physico-chemical change on the surface treated would seem to be so expensive that it would be cheaper to put on a decorative and a protective coating. The question of the effect of impurities was important and there must be an increased use of apparatus for physical examination of materials, although this would carry with it the need for a greater knowledge of chemistry than was perhaps generally possessed at the present time.

Structures of Laminated Material

Mr. W. GARVIE suggested that one way out of the problem of the desire for change would be to build structures of laminated material and when one became tired of the appearance, pull off one of the laminations and get a new surface. Perhaps the wallpaper makers could do something on these lines. Personally, he felt that we should develop, in decorative matters, towards having no vehicle at all, the surfaces being self-coloured resins or plastic materials, which could be sprayed on in molten condition.

Mr. F. J. KING suggested that in 20 or 30 years' time we should not see many of the things we used to-day except in the absolutely pure state, and with such standardised purity tremendous advances would be made. Plastics were likely to be an important development. For general decorative purposes he foresaw the use of plastics with permanent colourings Again, we could look forward to a wood substitute, or wood purified in some way, probably being broken up and recast into solid blocks, with the finish right through the material. For these reasons he believed there was a tendency towards permanence of finish, and a finish which we should not wish to be constantly changing.

Mr. S. W. KENDALL said flights of fancy such as the author had indulged in with regard to the future left him rather cold. His own view was that we should see a much further utilisation of paints because there were signs that some of the so-called indestructible materials, such as the stainless steel and chromium alloys used for shop fronts, were already beginning to show deterioration which could only be stopped by the application of suitable lacquers and paints.

The Author's Reply

Mr. DANIELS, replying to the discussion and speaking with regard to the comments made upon cellulose finishes, said that in spite of the fact that the industry was ten years old commercially, the amount of serious work that had been done was negligible, and he could not imagine the present cellulose nitrate persisting. One of the features of the discussion had been the tendency to criticise things in the light of the present state of knowledge, but we did not know what would happen 50 years hence and possibly there would be nothing in the nature of erosion, for example, in those days. His general argument was that paint would continue to be used for decorative purposes and he supported this view by pointing out that in 75 per cent. of cases, re-painting was carried out not because of lack of durability but because of the desire for a change of colour, and therefore the question of the life of the films hardly seemed to arise. Provided the film lasted sufficiently long for people to get tired of it, that would be all that mattered.

Italian Fertiliser Production

Statistics from the Montecatini Report

THE annual report of the Montecatini concern for the year 1931. as presented to the recent general meeting, makes considerable reference to the company's interest in fertilising and cognate materials. Dealing first with synthetic nitrogen fertilisers. the report states that Italian production last year amounted to 180,699 metric tons. against 195,064 tons in 1930. During the same respective periods consumption of sulphate of ammonia declined from 105,656 metric tons to 102,308 tons, and of nitrate of lime from 32,758 tons to 31,705 tons, on the other hand. the consumption of nitrate of soda declined from 75,000 tons in 1930 to 55,000 tons in 1931. The company's output of phosphate of ammonia has steadily increased, and sales last year amounted to 3,763 metric tons, three times the amount sold in the previous year. In the case of cyanamide. Italian production during 1931 reached 88,066 metric tons, of which quantity 25,166 tons were produced by the Montecatini's associate company, the Società Italiana Prodotti Azotati. The domestic consumption of cyanamide reached 78,249 tons last year, against 86,251 tons in the previous year. With regard to potash fertilisers, domestic production of which is in the neighbourhood of 5,000 tons, Italian consumption last year amounted only to 20,131 tons, against 45,049 tons in 1930; imports stood at 15,448 tons, compared with 39,488 tons in 1930.

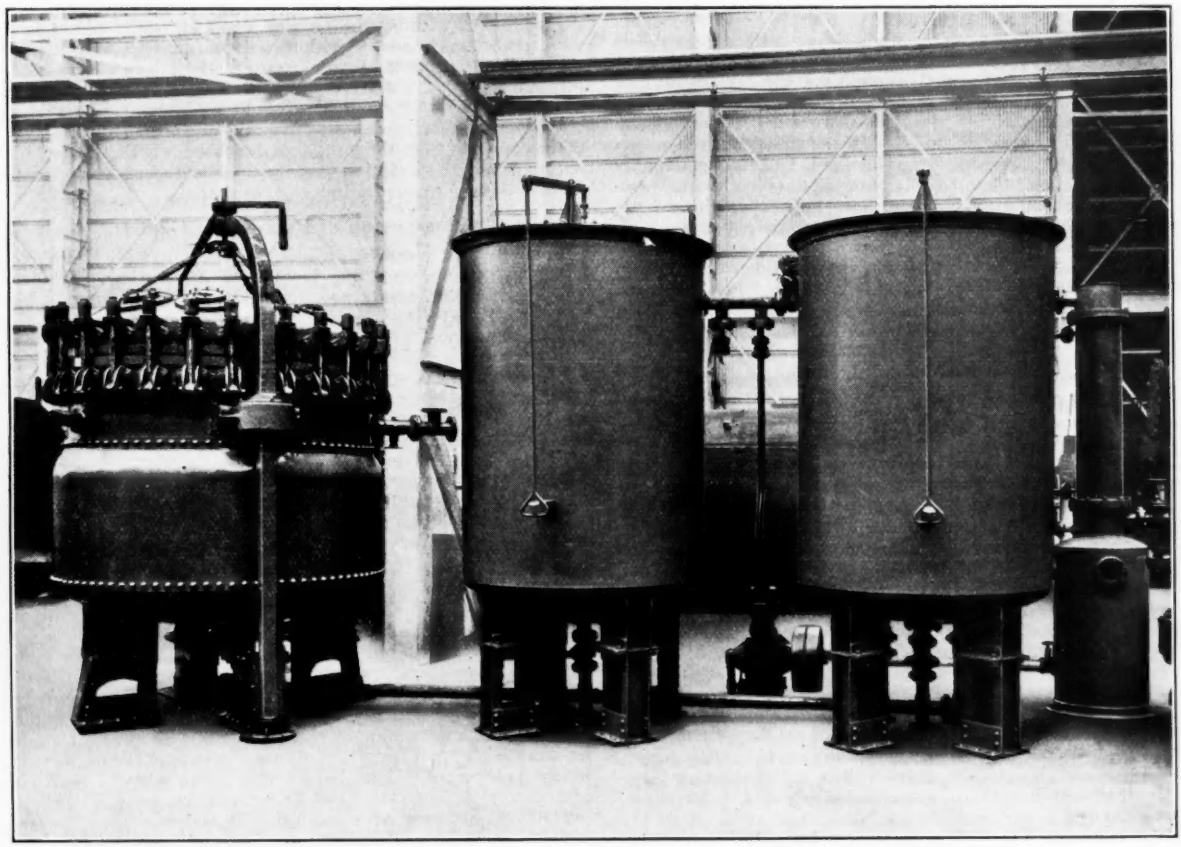
From a total Italian production of superphosphates, which reached 802,059 tons (against 1,388,076 tons), the various Montecatini companies produced 535,653 tons (against 637,454 tons). Last year domestic consumption of superphosphates was reduced to 892,500 metric tons, of which the company were responsible for 510,897 tons, The 1931 consumption represents a reduction of about 30 per cent. on that of the previous year. In addition to superphosphates, Italian agriculture also used 38,850 tons of basic slag and 3,725 tons of ground phosphate during 1931.

A Modern Vacuum Impregnating Plant

A Typical British Production

THE process of vacuum impregnation is now employed in many industries. In the electrical industry, for instance, cables, coils, armatures, and condensers are impregnated in order to improve the electrical properties of the insulations, the most important requirement being that all pores and interstices shall be completely filled with the impregnating compound. With the increasing tendency towards higher voltages greater attention is being paid to the impregnating operation, and it is now generally realised that in order to avoid breakdown the impregnation must be as perfect as possible.

The accompanying illustration shows a complete vacuum impregnating plant built by G. A. Harvey and Co., Ltd., Woolwich Road, London. It consists of a vacuum and pressure impregnating vessel fitted with jacket for steam heating and with a removable cover which can be lifted and swung on a davit, together with two liquid storage vessels, condenser, two-stage vacuum pump and air compressor. The materials to be impregnated are placed in the impregnating vessel shown on the left and are first dried, the moisture being driven over into the condenser and collected in the receiver below. When the drying has been completed a high vacuum is obtained by means of the vacuum pump, and the impregnating liquid is sucked into the impregnating vessels until the articles to be dried are completely submerged. Air is then admitted and the pressure in the impregnating vessel is raised by pumping in compressed air above the surface of the liquid. This serves to increase the penetration and make the penetration as complete as possible.



Vacuum Impregnating Plant constructed by G. A. Harvey & Co., Ltd.

Apart from the electrical industry, there are other interesting applications of the same principle. The impregnation of wood for purposes of preservation with creosote and other agents depends upon exactly the same principles, the only difference being that in this case the impregnated vessels are made in the form of horizontal cylinders into which the wood can be wheeled on bogies. Wood is also impregnated for purposes of staining, as the ordinary methods of wood staining only colour the outer surface. This method of staining has been applied industrially in the pencil industry in such a way as to enable cedar wood of uneven colour to be utilised and also to enable pencils to be made from other woods which have been stained to a cedar colour. Even the leads used in the making of pencils are now impregnated under vacuum with fatty materials.

More recently the same principles of impregnation have been used for securing penetration into porous materials not of liquids but of gases—for example, in sterilising fruits, oil-seeds, etc—and for killing weevils in bales of tobacco, food products, etc. It has been found that in attempting to kill the vermin in products of this kind mere fumigation was hopelessly unsuccessful, because the poisonous gases could not penetrate into closely packed materials. If, however, a vacuum be first of all produced the penetration can be obtained just as in the case of the liquids, and it has been found that, providing a good vacuum is produced, it is not difficult to combat the serious ravages of the pests which infest these products during transport.

Modern Oil Production Problems

By A. BEEBY THOMPSON

MR. A. BEEBY THOMPSON, vice-president, presented a paper on "Modern Oil Production Problems" at a meeting of the Institution of Petroleum Technologists at the Royal Society of Arts on Tuesday, May 10. Following are extracts from Mr. Thompson's paper.

OPERATIONS in the future dealing with deep sources must of necessity arrange for controlled output, however anxious a producer may be to benefit at the expense of his neighbour, he is no longer able to do so, except by an enormous outlay in excess drilling. Producers recognise to-day the value of gas as a propulsion agent for the oil contained in the pores, crevices, etc., of the oil-bearing rocks, and in consequence they are all desirous of maintaining a low gas-oil ratio. Furthermore, they appreciate the importance of regulating as far as possible the rate of depletion, so that pressure readjustments can be equalised to avoid irregular influxes of edge or bottom water. Operators are also perturbed by the difficulties of raising oil from very deep wells when they have ceased to blow and the fluid level falls. Unitisation has found its supporters as a result of a recognition of those accepted principles plus the urgent need for controlling he higher production from the deep sources of supply.

Deep drilling, with its consequent problems, is compelling a degree of co-operation never before experienced between producers sharing acreage in an oil pool, and unquestionably this has facilitated the friendly reception given to the plan of unit operation. Some fortunate concerns with ample means and commendable courage and foresight have been able to secure for themselves the whole probable area covered by an oilfield, but this is the exception and not the rule, and to-day competitive drilling and boundary fights continue, though as a rule with less aggression than formerly, as it is a costly game.

Scientific Calculations

Technologists in close touch with oilfield events confidently believe that they will in time be able to unfold a scheme whereby the equitable proportion of each lease or block of acreage can be reasonably safely calculated from well logs, core analysis and a more comprehensive understanding of subsoil phenomena. Serious efforts are being made to evolve scientific methods of fairly allocating the production of oil pools shared by many competing interests. Obviously the necessary data for such calculations would only be known at a somewhat late stage in the development of a field, but by pooling a certain percentage of the proceeds of joint action, it might be possible to provide for readjustments from time to time so that each working interest derived his share of the oil which might reasonably be expected to have underlain his land.

There are obviously many difficulties connected with a programme of this character, and at present such widely differing views are held concerning the distribution of oil, gas and water, and their usefulness, that only by a very large measure of self-sacrifice and compromise could it be entertained. Perhaps the stabilisation of prices at a profitable level by systematic co-operation and unit operation of fields might compensate for the sacrifice of competition, although one instinctively fears the consequences of removing the incentive of competition in industry and in life generally. Anything which tends to impede or suppress individuality and enterprise is likely to be harmful to progress.

Production Methods

Modern production methods in deep territory resolve themselves into three main divisions: (a) Production during the natural flowing period when there is sufficient gas pressure to cause natural flow; (b) production by artificial methods when the gas is insufficient to lift the oil to the surface unaided; and (c) recovery of dregs.

Only within recent years have precautions been taken to measure and control pressures; indeed, the main object of most producers was to extract the maximum amount of fluid in the minimum of time with the least trouble, regardless of thoughts of conservation. Open flows were encouraged, and swabbing, bailing and air/gas lift were employed to recover a maximum of production when natural eruptions diminished or ceased; consequently, very little trustworthy data is available concerning pressures down to depths of, say, 3,000 ft.

The mechanical extraction of oil from deep wells is a constant source of thought and anxiety to oil producers. Until now means have been devised to adapt old methods to deep wells solely on account of the great strides made in metallurgy and the heat treatment of metals plus the closest attention to design and mechanical details, such as the fit of pump barrels, the construction of pump rods, the balancing of reciprocating parts, etc., etc., but the raising of oil some 5,000 to 10,000 ft. involves pump pressures up to several thousands lb. per sq. in., which demand careful handling, and also the frequent withdrawal of pump barrels and, perhaps, tubing for cleaning out wells introduces a very serious hazard. A time can be envisaged when it may be possible by suitable control of field pressures and re-introduction of fluids to exhaust the oil sands so completely of their contents that the dregs will not be worth the trouble and expense of extraction, but meanwhile the problem has to be met in face of increasing competition.

Conversion of Petroleum Gases

Much research work has been undertaken with the object of finding some economic method of converting petroleum gases into other useful products, but no signal success has resulted therefrom. A limited trade is done with the products that can be liquefied at workable pressures, so that they can be sold in cylinders for use as such or for lighting in remote districts where other forms of fuel are costly. The disposal of surplus gas from new prolific fields is always likely to be a source of difficulty, as it is only after developments have reached a very advanced stage that the potentialities can be approximately predicted, and until these can be calculated there is a natural disinclination to embark on long-distance pipe lines. Some guarantees of reasonable permanence must be obtained before finance can be found for distant distribution and the negotiation of franchises for city or public supplies can be undertaken.

Reference has been made to the possible absence of recoverable oil dregs in fields where operated from inception in accordance with modern ideas on a unit basis. It does not require a wide stretch of imagination to picture the time when, by methodical exploitation of a suitable pool, the oil contents could be forced into a position where it would be held under a pressure between a body of gas at high points and a volume of water on the low flanks, so that oil could be drawn off at a rate which would maintain equilibrium. Many years may elapse before this ideal will be realised, although this seems to have been approximately in Persia, but the application of present-day knowledge to a normal regular structure of modest extent would go far towards reaching that goal.

The handling of dying oilfields developed by past competitive methods with little regard to conservation is the immediate anxiety of petroleum technologists, and the problem is rendered doubly difficult by the lack of reliable information. Most geologists are now prepared to admit that many of the curious anomalies shown on sub-surface contour maps do not exist, but were due to plotting data supplied by wells which had deviated from vertical. Only by a survey of many wells in a deep field could a faithful sub-surface structure map be reproduced, and this would be a costly performance.

Spanish Potash Production

THE Spanish regulatory office for the production, manufacture and sale of potash has fixed the minimum production for 1932 at 50,000 tons of potassium chloride, 80-84 per cent., and the maximum at 250,000 tons chloride or its equivalent in the form of other salts.

Safety in the Chemical Industry

By J. DAVIDSON PRATT

MR. J. DAVIDSON PRATT, general manager and secretary of the Association of British Chemical Manufacturers, in a recent paper on "Safety in the Chemical Industry" read before the Nottingham Section of the Society of Chemical Industry, emphasised the need for the closest study of safety by all technical men. Industry, he pointed out, is steadily expanding and new products are continually being manufactured and used, and these introduce new hazards which must be fully appreciated in all their bearings if safety is to be assured. Following are extracts from the paper.

THE technical hazards of the chemical industry may be divided broadly into three sections, namely:

(1) Fire and explosive risks.—These may occur not only with substances of known explosive properties such as picric acid and T.N.T. but also with inflammable solids such as celluloid, liquids like carbon bisulphide or benzol, gases such as acetylene or hydrogen, or dusts. They also arise with high pressure vessels and with reactions liable to get out of control.

(2) Gassing risks.—These arise from the inhalation of gases, vapours, dusts or fumes of a poisonous or deleterious nature, such as chlorine, sulphur dioxide, and compounds of lead and arsenic. The dangers which arise from an insufficiency of oxygen in the atmosphere may be included under this head.

(3) Corrosive risks.—These are due to the action of corrosive or deleterious materials on the skin, such as strong acids, amino derivatives and hot liquids.

Fire and Explosive Risks

Fire and explosive risks may occur with solids, liquids, gases or vapours, liquefied or compressed gases, and dusts. Apart from substances with recognised explosive properties, many substances are inflammable or combustible and can be ignited by a flame or spark or by being heated to a sufficiently high temperature. Some of them may generate sufficient heat under certain conditions, or when in contact with certain other bodies, to cause ignition. Some solids may on combustion develop explosive properties, whilst others may be ignited by shock or friction, in the same way as scheduled explosives. There are also some which are liable to explode in contact with other materials, for example, chlorates in contact with organic matter or sulphur can be readily ignited by friction.

The same remarks apply as in the case of solids. The flash point may be regarded as a fair indication of the fire risk with liquids, though obviously the temperature at which the liquid is being handled will play an important part. The lower the flash point the greater the danger of ignition. Liquids have, however, an additional source of danger in that the vapours which they emit may be inflammable or explosive.

Gases or vapours may be ignited or exploded by heat as well as by a flame or spark, in the same way as solids or liquids, but the temperature must, as a general rule, be comparatively high to produce ignition or explosion by heat alone. In general, however, combustible gases or vapours are not actually explosive except when mixed with air or oxygen, and then only when the mixture is within certain definite proportions. The limits differ for each gas or vapour. Regarded from this point of view, the explosive gases and vapours lose a good deal of their dangerous repute, since often in practice the ratio and concentration of gas and oxygen in the mixture will not fall within the explosive limits. Owing to these circumstances, the industrial world is spared countless explosions. The possibility of explosion with gas mixtures not containing oxygen must not, however, be overlooked.

Liquefied or Compressed Gases

A primary danger arises from the fact that liquefied or compressed gases are under pressure and that explosions may occur if they are handled or stored in vessles of inadequate strength. There is a further danger with gases of an inflammable nature in that escaping gas may be ignited by a flame, a spark, or any incandescent material. An important cause of ignition, particularly with hydrogen, is a static discharge of frictional electricity generated by the flow of the gas through the nozzle of the container. There is a specific danger with liquid oxygen in that it may form explosive mixtures with organic substances.

The possibility of a severe explosion through the ignition of a dust cloud by a naked light or spark is always present in a factory or warehouse where carbonaceous dust is produced. The same risk may arise in the case of the dust from many other substances, including metals, for example, aluminium, which in the compact state will only burn with difficulty, if at all. In fact it is asserted by some authorities that nearly all finely-divided organic or metallic substances are liable to explode when mixed with air and ignited and it would certainly be sound policy to treat the risk as existent. As a general rule, the finer the dust and the more complete its mixture with air or oxygen, the greater is the danger of explosion.

The extent of the danger from dust explosions is not generally recognised, although several explosions occur every year. During the six years 1921-26, thirty-seven such explosions came to the notice of the Factory Department of the Home Office, causing five deaths and, in some cases, much damage to property. Of these, malt dust caused 7; sulphur, 5; coal and seed, 4 each; grain, flour and dyestuffs, 3 each; cork, 2; and ebonite, rubber, aluminium, pitch, sugar and oatmeal, 1 each. Other substances of interest to the chemical industry which produce dusts capable of igniting and readily propagating flame are cellulose acetate, celluloid, naphthalene and a number of dyestuffs, for example, those containing undecomposed diazo groups, such as some of the chrome blacks and browns.

Some Necessary Precautions

"Cleanliness is next to godliness" is a sound motto for any industries using dangerous materials. Cleanliness should be construed in the widest possible sense and as meaning that everything should be in its right place and nowhere else. If this is carefully observed, the first essential to safety will have been assured. Solids, liquids and gases should not be allowed to escape from the plant, and if they do, immediate steps should be taken to deal with such an escape.

No electric arc lamp or naked light, fixed or portable, should be used in, on, or about any part of the works where such danger exists. All incandescent electric lights should be in flame-proof enclosures and be properly protected by substantial guards if there is any danger of breakage. All switches and fuse boxes for electric light must be outside the building or danger zone, and where the risk is serious it will be well to have the electric lamps outside, the light being admitted through suitably located windows which cannot be opened.

Portable electric hand-lamps connected by flexible wires should never be used where there may be inflammable vapours. These have been the cause of numerous accidents, especially in inspecting tanks or vessels which have contained inflammable liquids. Any of the approved patterns of miners' safety lamps may be used instead. Gas jets are permissible for lighting purposes, but should be used only where safer means are not available; they must obviously be outside the building, behind strong closed windows and with a gas-tight setting to prevent vapour from inside the building reaching the gas jets. The flame must be protected against accidental extinction by the wind, while there should be means for the early detection of any gas leaks.

In rooms where there are volatile and inflammable liquids, or where there is a risk of dust explosion, no internal combustion engine, or electric motor, unless of totally-enclosed pipe-ventilated or flame-proof type, should be installed and no electrical equipment capable of generating sparks, such as motor starter or electric bells, should be fitted.

Static Electricity

Precautions should also be taken against the dangers of static electricity which may arise from a variety of causes, such as in pumping and discharging liquids or gases,

grinding of chemicals, and the movement of belts and machinery. Flameless methods of heating products or reaction mixtures should be employed where there are serious fire risks, but in practice it is not always convenient to do this. When open-flame burners are used, the danger may be much reduced by enclosing the burners in an entirely separate chamber so arranged in relation to the plant that escaping vapour or liquid will not come into contact with the flame. Similarly, the artificial heating of such places should be done by steam, hot water or other flameless methods.

A danger that is sometimes overlooked is the risk of ignition from sparks produced from the use of iron or steel tools, especially when doing repairs, or from the heat generated by the friction of belts or machine parts, or by the over-heating of bearings. As an example of how danger may arise in unexpected ways, it has been found that the delivery pipes of an air compressor have become red hot. This temperature is sufficient to ignite many vapours. Carbon bisulphide is particularly susceptible, and even a warm lamp, though fully enclosed, has been known to cause ignition.

While the need for precautions to prevent the presence of any possible source of ignition will be obvious with liquids of low flash point, there will often be difficulty in practice in deciding whether such precautions are really necessary or not. The Factory Department of the Home Office, with which the problem has been discussed, has suggested that in all case of doubt, the firm concerned should consult the local inspector and endeavour, in conjunction with him, to arrive at a decision as to the extent of the special precautions necessary in the particular case.

Gassing Risks

Gassing risks arise from the action of gases, vapours and dusts on the human organism, more particularly when taken into the system through the mouth and nose. Under this definition is included the action of gases, vapours and dusts on the eyes. The effects of solids and liquids on the skin or when absorbed through it on the system are regarded as falling within the heading of corrosive risks. In other words, "gassing risks" refers to air-borne dangers, whilst "corrosive risks" deals with all direct contact hazards.

Gassing risks are often associated with fire and explosive risks; for example, the vapour of benzol is not only poisonous but can form an explosive mixture with air, so that in planning the necessary safety measures both hazards have to be taken into account. In the same way corrosive and gassing risks may be associated in cases where the liquid, for example, hydrofluoric acid, exerts a deleterious action on the skin, in addition to producing a poisonous or irritating vapour.

Methods to protect workers must include the following measures: (*a*) the avoidance of dust or fumes by using wet processes or by installing automatic or enclosed machinery. (*b*) the removal of the dust or vapour by natural or mechanical ventilation, (*c*) the isolation in a separate room or building of the process or machine by which the gas, vapour or dust is generated, and (*d*) the use of protective devices, such as respirators, helmets, etc., by the workers.

The primary consideration for protecting the worker against gassing risks is to take every precaution against the escape of the dangerous material into the atmosphere and especially into that of the workroom. The use of automatic or totally enclosed plant and machinery will in many cases achieve the desired object, and too much attention cannot be given to the design of the plant to ensure that there will be no escape of dangerous gas. This should be regarded as the basic method of ensuring safety. Where conditions of working make it impossible to achieve this ideal, then adequate ventilation should be provided, and this should be designed so as to carry the dangerous vapours away from the workers. In general, this is best achieved by means of exhaust ventilation, and the ventilating arrangements should be constructed so as to draw off the fumes as near as possible to the point of liberation, so that they do not get into the air of the room.

Corrosive risks arise from the direct action on the skin of substances such as strong acids and alkalis, or from the absorption of poisonous materials through the skin as with gassing risks, the effects may be more or less immediate, as with strong acids, or they may take some considerable time to become apparent, as in the case of pitch warts, which occur among men who have been handling tar products for a long period of years. Dermatitis, or skin trouble, of a persistent nature, may also occur from the chronic handling of products which have no apparent effect at the time. The basic precaution is obviously to prevent contact of the skin with the dangerous material. As in the other cases, proper attention to the design of the plant and to ventilation will do much to eliminate the danger. Where the manipulation of corrosive substances such as acid cannot be carried on without risk of personal injury from splashing or otherwise, the workers should be protected by means of gloves and goggles, and, if necessary, protective clothing. Personal cleanliness on the part of the workers and immediate and thorough washing of any part that may come into contact with the material will go a long way towards safeguarding the workers from the results of working with corrosive products over a period of years. This need for cleanliness cannot be too strongly emphasised.

Safety in New Manufactures

Rule 2 of the Model Safety Rules issued by the Association of British Chemical Manufacturers reads as follows:—

"Before commencing any new manufacture the employer should take steps to ascertain definitely whether there are any special dangers attaching to the operations involved, and whether the substances used, or made at any stage, possess any properties which necessitate precautions being taken for the protection of the workers. The design of the buildings and plant should be based on the information thus obtained, and appropriate rules framed for the observance of workers in the process."

While the principle underlying this rule appears obvious, many accidents have occurred in the past through neglect of the measures therein suggested. During the research and the semi-technical scale development leading up to bulk production, a special study should be made of the materials used or produced, and of the processes, at every stage, from the point of view of explosibility, inflammability, poisonous or deleterious properties when inhaled, taken into the system by the mouth, or when in contact with the body in any way, whether as vapours, fumes, dusts, liquids, or solids, and of the conditions which may lead to uncontrolled reactions and consequent dangers. The possibility of substituting non-dangerous for dangerous reagents should always be carefully considered, *e.g.*, in the case of solvents, non-inflammable liquids may, in view of the reduced fire risk, prove less costly in the long run than inflammable liquids, even though their actual cost may be higher or their efficiency lower. Special experiments will in most cases have to be undertaken to obtain the whole of this information.

The determination of physiological properties will in many cases be impossible with the facilities which normally exist in chemical laboratories and, in such circumstances, it will be advisable to call in the help of a physiologist or pharmacologist to advise as to the nature of the tests to be made and to exercise general supervision over their execution. In this connection special attention must always be paid to the effects which may be produced on the worker by prolonged contact with the substances used, or by the prolonged inhalation of contaminated air, even when such contact or contaminations may be slight, *e.g.*, with lead, arsenic compounds, aniline, nitro-chlorobenzole, and similar bodies. Many poisons, such as compounds of arsenic and lead, have a cumulative effect, which will only become apparent after months or even years of working. Tests on animals, if suitably arranged, should provide indications as to whether such cumulative effects are likely to occur. In all cases where there is any suspicion that prolonged contact or exposure may cause injury, steps should be taken in designing and operating the plant, fully to safguard the the workers.

Planning a New Works

In choosing a site for a process of a dangerous nature, certain special features require close consideration in addition to the normal questions of labour, transport, fuel,

power, distance from raw material and markets. rates, etc., which are common to all industries. Water supply should be plentiful. Disposal of effluent or ultimate destination of normal and abnormal discharges of liquids and gases, fall of ground and prevailing winds as affecting the natural course of liquids and fumes respectively, will repay close study from the safety aspect and from the point of view of amicable relations with the surrounding population. A cramped works may be successful, but an ample area will prove a good investment, especially in regard to safety. In other words the arrangement of buildings. machinery and equipment should be studied from the standpoint of safety, just as it is studied from the point of view of economic production.

As a general rule the more dangerous the process the further it should be from other danger points and from areas of high labour density. Reasonable distances should be maintained between dangerous and other operations, and if site or control requirements make this difficult, the construction of buildings should be such as to make up for the lack of distance. Advantage can often be taken of natural features of the ground, which will assist in isolating some particularly dangerous operation, while mounding or wall surrounds may at times be necessary.

Operations involving fires, furnaces, etc., should be grouped as far as possible into one or more fire areas, which should be kept as far as practicable from fire and explosive hazards.

Liquid Discharges

If on sloping ground, liquid discharges must be allowed for, and these should be capable of control so as to exclude the possibility, even in case of accident, of inflammable material reaching a fire area. Buildings with inflammable liquids should be specially designed to prevent the spread of liquid that may result from an accident.

It is important that due regard should be taken of the nature of the operations in the neighbourhood when placing a plant. This is well exemplified by an accident which occurred near Grenoble in 1917 in a factory for the industrial manufacture of oxygen from liquid air. Some 300 yards from the oxygen works was a factory making chlorine derivatives of acetylene, and an appreciable quantity of the acetylene was liberated into the atmosphere in the initial stages. A week after the manufacture of the acetylene derivatives commenced, the distillation column of the liquid air apparatus exploded, due to the gradual concentration of the acetylene with the formation of an explosive mixture in contact with the liquid oxygen.

Similarly, works manufacturing chlorates may be greatly endangered by the proximity of plant from which sulphuretted hydrogen may be liberated. Should this gas find its way into the chlorate works, it will act on the metal machinery and apparatus, thereby producing metallic sulphides, which will cause explosions on the slightest provocation if they come in contact with the chlorate. Hence, it is desirable to avoid placing works disengaging sulphuretted hydrogen or treating metallic sulphides in the vicinity of a chlorate factory, or *vice versa*.

Careful attention to the design of plant will go a long way towards making a process safe, and this again involves a full knowledge of the process and products to be handled. The design should be such as to ensure the minimum risk of escape for dangerous materials, and an easy means of dealing with any escape which may occur, whether of gas, liquid or solid. Easy cleaning and easy inspection are also essential, for on these factors much depends. This becomes of particular importance when it is necessary for men to enter vessels to carry out the work of inspection or repair.

What the Association has Done

The Association of British Chemical Manufacturers, first decided to take up safety work about four years ago, when it became necessary to deal with a number of technical questions arising under the Factory and Workshops Act and the Chemical Works Regulations. It was soon found that there were many precautions of a technical nature on which there was considerable divergence of opinion, while there were certain risks which were not fully appreciated. The Association therefore prepared and issued a set of Model Safety Rules for use in chemical works in order to bring together, in a clear and concise form, the various principles which require consideration in connection with the manufacture of various types of dangerous materials. The rules are in two parts. Part 1, which was issued three years ago in provisional form, consists of the safety rules themselves and sets forth briefly the principles to be observed. Part 2 consists of a detailed discussion of the various points and contains a more extended explanation of the objects intended to be achieved by the Model Rules, of the dangers arising from their non-observance, and of the methods for obtaining the desired results. In short, an attempt is being made in Part 2 to bring together in a form convenient for use, the large mass of valuable information regarding safety measures in chemical works which is either available in scattered publications and reports or which, while in the possession of individual manufacturers or of the Government Departments concerned, has so far not been published. The first section of Part 2, dealing with fire and explosive risks, was issued over a year ago in provisional form, and the preparation of the rest is in hand.

Safety Circulars

At an early stage the Association came to the conclusion that greater publicity should be given to the causes of certain accidents which occur from time to time, in order that the industry may benefit by this experience. A service of Safety Circulars was therefore initiated. These circulars, of which some 54 have already been issued, are generally based on the reports of interesting or unusual accidents from which a useful lesson may be learned, and they contain not only an explanation of the cause of the accident, but also the recommendations of the Works Technical Committee of the Association as to how similar trouble may be avoided in future.

The Association holds the view that questions of safety should be regarded as in the same category as medical science and that the widest circulation of useful information should therefore be secured. As part of this policy it has been able to arrange for a scheme of collaboration with the corresponding French and German chemical organizations, which will secure the pooling of non-secret information pertaining to safety, such as reports of unusual accidents, safety devices, etc. Co-operation is also maintained with the National Safety Council of America. The Association also works in the closest harmony with the Factory Department of the Home Office, and with the Chemical and Allied Employers' Federation. These arrangements go a long way to ensuring that the industry in this country benefits from all the useful experience both in this country and abroad. Furthermore, while these safety services are intended primarily for its members, the Association is willing to make them available for other interested organizations under certain specified conditions.

Photographic Emulsions

Researches at the United States Bureau of Standards

THE April issue of the "Bureau of Standards Journal of Research" contains a report on the Bureau's investigations of photographic emulsions. This report is introduced by discussions of previous experimental and theoretical work on silver and hydrogen ion conceptions in emulsions, and a description of experimental technique. These variable are taken up first according to their effects on after-ripening, and second according to their direct effects on sensitivity when changes in after-ripening are eliminated (in experiments after digestion). The rate of after-ripening increases with increasing silver ion concentration and increasing *pH;* the corresponding effects on sensitivity are much larger than those produced by the direct effect on environment(after digestion). The combination of silver ion with gelatin reduces the effect of excess silver; illustrations are given for the distribution of excess bromide or silver in the emulsion with changing *pH*. The desensitising action of bromide (after digestion) is found to increase with increasing acidity; conversely, the effect of *pH* is dependent on the silver ion concentration. Spectral sensitivity of the emulsions is found to be independent of hydrogen or silver ion concentrations; these variables must, therefore, influence sensitivity through secondary reactions in latent image formation.

Phenolic Resin Plastics

A Brief Review of Their Development

AMONG the numerous developments of applied chemistry, it is probably right to regard the development of the phenolic resins in recent years as one of the outstanding examples. Since the pioneer work in this field by Dr. L. Baekland in producing condensation products of phenol and formaldehyde, which had the practical result of giving to industry new materials known under the general term "bakelite," an enormous amount of research has been carried out in this field. While the original simple products from phenol and formaldehyde still constitute materials which fully retain their place in industry, many other raw materials including cresols, coumarone, indene, resorcinol, furfural, hexamethylenetetramine and urea have now been utilised to produce more or less similar products. The rapid rise in popularity of these products is due to an extraordinary combination of valuable properties, especially of the basic hardened resinoids, including great hardness, strength, rigidity, insolubility, high electric insulation value, chemical inertness, and also their property of being moulded into any desired form, as well as being easily worked. Means have been discovered to overcome the earlier tendency to brittleness of these products, and to make varieties possessing great flexibility without loss of other desirable properties, and such products can now be generally modified in almost any direction to suit special purposes.

Variety of Forms Available

According to Dr. L. V. Redman, who is director of research and development to the Bakelite Corporation, of Bloomfield, New Jersey, the chief forms in which these resins are supplied include: (1) transparent materials composed of heat-hardened resinoids, with or without dyes or colour pigments; (2) varnishes or solutions of resinoids in their fusible, soluble, and unhardened state, used for the purposes of impregnating electric coils, fabrics or paper for the production of the so-called laminated stock; (3) paper of laminated form, prepared from varnish-coated paper dried and heat-pressed into multiple layers of desired thickness; (4) cloth of similar laminated form, prepared from varnish-impregnated cloth, dried and hot-pressed in the same way as paper; (5) moulding materials, prepared by intimately incorporating potentially reactive resinoids without fibres or other fillers, fashioned under hot-pressure in hard steel moulds to give objects of any desired form and size, and to extremely accurate dimensions;; (6) cements consisting of the so-called "A" type of resinoids, alone or suitably modified, which find employment in the basing of electric lamp bulbs and radio tubes, and in the bonding of fine abrasive materials as in grinding wheels; (7) varnish resins, soluble in drying oils to form with these "air-drying" protective coatings of a character much superior to those obtained by the use of natural resins.

In 1931 when the bakelite patents expired in Germany, a large number of firms in that country took up the manufacture and working of phenolic resins. This led to a great expansion in the use of such material in Germany, as well as a considerable reduction in price. The materials have an extraordinary wide range of uses, and their high insulation value and other desirable properties have given them a special place in the electrical industry, and also a wide use in all kinds of household equipment, because they lend themselves to close imitation of expensive materials such as ivory, horn, tortoiseshell, amber, and other more or less valuable substances. The Ludenscheid Works in Westphalia now manufacture a great variety of objects of this plastic material for household and other uses, including the bristle settings for hair and tooth brushes, hair combs, buttons, beads, boxes for cosmetics and powders, spectacle frames, knife and fork handles, etc.

There are two principal groups of plastic material of this type, one of which (like bakelite) contains no nitrogen, the other containing nitrogen in which urea or some other amino compound is employed in the manufacture. In the original condition, the finished material has the colour and appearance of amber, and is extensively used to imitate amber in necklaces, cigarette and cigar holders, and other purposes for which real amber is frequently used. Mixed with filling materials, such as powdered wood, different kinds of rock powder, asbestos, mica, paper or textile fabrics, the properties of these plastic materials can be extensively modified. According to the filling material used, different working materials may be produced with the desired mechanical properties, and with high resistance to heat and chemical attack. By the selection of filling material, the cost of the finished product can also be varied over a wide range, so that prices can be made to fit the purpose for which the article is intended.

Moulding Technique

While the material can be coloured in any desired way, it is usual to employ the darker colours, because of a tendency of the material to slightly darken in time. Mixed with the filling material in suitable proportions, the plastic substance and filling, in powdered form, is pressed in moulds to the desired form. The operation is said to resemble in some respects the vulcanising of rubber, and the chemical transformation is not entirely dissimilar. The pressure must be at least 200 kg. per square centimetre, and the temperature about 180° C. Under such conditions, the material liquefies in the first place, and then passes from the "B" form to the "C" form and hardens very quickly. This transformation is not fully explained; it is not merely a physical change, but a definite chemical alteration. The material cannot be brought back to the "A" or "B" form, which suggests a difficulty in utilising old material. This problem has not yet become very important; its solution will doubtless be achieved in time, analogous to the regeneration of old rubber. The finished pressed objects leave the steel forms with a completely smooth and polished surface, if the process has been properly conducted, but due care is needed, and the material supplied to the forms must be exactly measured, so that it is neither too much nor too little in quantity. This is often facilitated by a previous compression of the material into tablets or cylinders, of which a specified number is used for each charge; if used in granular form, as is necessary in producing certain colour effects, the charge for the mould is accurately measured.

There is scarcely anything, other than where metal is essential, that cannot be made of this pressed material. The present many-sided uses are due, among other things, to its almost perfect insulating properties, its good resistance to heat, its non-inflammability, resistance to most kinds of chemical attack, and impermeability to water. The largest use made of these plastic materials is in the electrical manufacturing industry, in which it is employed for small and large parts, including telephone apparatus, electric light switches, etc. The parts are pressed with any necessary holes, thus avoiding a good deal of after work. By the use of appropriate filling material, particular properties are given to the finished products, and material is provided to meet many wants. Fabrics impregnated with a solution of the resins, pressed into plates or any other desired form, are sold under a number of different trade names. They represent a tough, strong, hard material, especially valuable for the electrical industry because of the good insulation value. Mention has already been made of the use of this material for "silent gear," or where silent operation is desirable.

Varnish-Coated Papers

The varnish-coated paper can be compressed to form plates or shapes of any kind; tubes are manufactured of this material, the paper being wound around a metal "thorn" and simultaneously compressed through heated rolls. The natural colour of these papers is a light brown but it can be made in black or other colours. The surface is smooth, and, by the use of metal plates, it can be produced with a good polish. By employing covering leaves produced in the photo-chemical way, wood-grain, marble, and many other pleasing effects can be produced on the surface. The material is highly resistant to chemical influences and to wide fluctuations in temperature, and because of its good

appearance and resistance to weather influences, this hard paper is used largely in the construction of automobile bodies, for wall coverings, for radio apparatus, as well as in the construction of electrical machines and apparatus. Tubes made from this laminated paper can be of any cross section; it is employed for high tension, as well as ordinary electrical purposes, and high tension insulators out of this materials are made on a large scale. Next to mica, this laminated paper makes the best insulating material, especially as mica in large sheets is comparatively expensive.

Phenolic resin varnishes require no heat treatment. After one year's exposure under sub-tropical conditions on the sea coast they show no sign of cracking or other deterioration, and retain most of their original gloss under conditions that leave little trace of the best standard spar varnish coatings. The need for protective coatings that really protect has always been felt, and there is reason to think that these new phenolic resin varnishes will satisfy this want for the first time.

The chief physical properties of the phenolic resin products have recently been determined by the Verband Deutscher Electrotechniker, representative data being given below. Type No. 1 represents a product in which asbestos is used for the filling material; No. 2 is a material with a wood-meal filling; and No. 3 is a material in which the filling is a textile fabric.

	(1)	(2)	(3)
Specific gravity	1.8—2.2	1.3—1.5	1.2—1.4
Bending stress Kg/cm²	700—800	900—1000	1000—1400
Tensile strength	400	400	500
Compressive strength	2000	2000	2000
Brinell hardness	60—70	50—60	50—60
Mod. of Elasticity Kg/cm²	700—800	400—500	400—500
Impact strength 5 mm. thick	20	40	40
Dielectric constant	10—25	6	6

Compared with metals, these materials have less tensile strength and resistance to impact, and for this reason type No. 3 has been brought on the market, as its fibre filling gives it an impact resistance equal to twice that of cast iron.

Use of Fertilisers in Canada

Now on a Commercial Basis

THE use of fertilisers in Western Canada is now on a commercial basis for the first time. Substantial results have already been achieved in the older sections of the country and extensive experimental tests in Western Canada have suggested remarkable possibilities. Last year's experiments were upon a sufficient scale to be thoroughly convincing to the farmers and large sales are now being made. As research continues and the benefits derived by the farmers become more widely known, the use of these artificial plant foods will be more general and this is bound to bring about extensive changes in methods of agriculture. A large proportion of the fertiliser used is still imported, but Canadian companies are increasing their output of products especially adapted to Canadian requirements.

Dr. Donald M. Marvin, economist of the Royal Bank of Canada, states in the Bank's monthly letter for April that it was over thirty years ago that the famous British scientist, Sir William Crookes, made the startling statement that unless we took advantage of the inexhaustible supply of nitrogen in the air to supplement the Chilean nitrate, the world would eventually face starvation. This was 125 years after the original discovery of nitrogen. Strange to say, however, it was not nitrogen for food, but nitrogen for war, that supplied the incentive for the discovery of methods of taking nitrogen from the air. Production continued after that incentive had been removed, and increased by 50 per cent. between 1925 and 1928. The world's capacity for producing natural and synthetic nitrogen is now estimated at 3,125,000 tons per annum against a total consumption of only 1,900,000 tons. The Canadian capacity for the production of nitrogen for all purposes is placed at 70,000 tons, but sales of mixed fertilisers during the year ended June 30, 1930, were reported to contain less than 5,000 tons. This, however, was more than 50 per cent. greater than the quantity used during the preceding year.

Influence of Fertilisers

Phosphoric acid tends more particularly to promote the root development in the early stages of growth and the production of seed or fruit in the later stages. It also hastens the maturity of the crop, an important feature where delayed ripening from a cold or wet season or danger from early frosts constitute a menace. Potash is essential to the formation of starches in potatoes and grains, the sugar of fruits and vegetables and the fibrous matter of plants. It also aids in the production of proteins and in the formation of well-developed grain. An ample supply of potash in the soil tends to reduce the susceptibility of crops to fungus attacks. By stimulating growth, the addition of only one of these elements to the soil tends to exhaust the supplies of these other forms of plant food. To overcome this difficulty, mixed fertilisers have come into use. These are produced in various proportions to meet the needs of different crops and soils.

Various experiments and tests have been made of the results following the use of proper fertiliser. For the orchards of the Maritime Provinces and British Columbia, nitrogen and phosphoric acid have been produced in the form of fish meal. Fruit production has been found to be influenced in a marked degree by the supply of available nitrogen in the soil. Nitrogen, alone, however, may result in too great a growth of wood and a balanced fertiliser has come into more general use. Colour, size and keeping qualities, as well as yield, have responded to the use of fertiliser in apple orchards.

Of all the ordinary farm crops, potatoes are perhaps most responsive to the use of fertiliser and it has been extensively used by potato growers for many years. Other vegetable crops, such as sugar beets and turnips, also respond readily to the application of fertiliser. Market gardeners are perhaps the most intensive cultivators and use large quantities of fertiliser in producing early crops of high quality vegetables and fruits for the city markets.

The use of fertiliser for the improvement of pasture land has developed in Canada only within recent years, but has long been practised in Great Britain, particularly on permanent pastures. The fertilising and controlled grazing of pastures enables them to carry a larger number of animals. In dairy herds, milk production is increased, in beef herds and sheep, the rate of gain in weight is accelerated, because of earlier grazing in the spring, more abundance in summer and later grazing in the fall, with a correspondingly decreased requirement of commercial or grain feed.

Practice in Western Canada

The fertilisers which are coming into general use in Western Canada are ammonium sulphate and triple super-phosphate. These are drilled in with the grain at the time of seeding by means of a special attachment to the seed drill, instead of being spread over the land as in Eastern Canada. The treated crop invariably showed stimulation early in growth with increased vigour of foliage and greater root development. The fertiliser apparently supplied the treated plants with food which the untreated plants in the check plots were not able to obain under the relatively cold conditions existing in the soil early in the season. The treated plants were also able to make better use of the available soil moisture and to develop a more sturdy growth. The early growth of the plant tended to prevent soil drifting. Weed development and damage from insect pests and rust were also materially lessened. Early heading of the treated grain was one of the outstanding observations; differences of from three to fourteen days were noted. Earlier maturity generally followed; in Manitoba and Saskatchewan this averaged five days in the 1930 experiments. Increases in yield ranging from 18 to 50 per cent. were reported with only a comparatively small proportion of the tests failing to show some gain. Differences in maturity were reflected in the subsequent handling of the crop and its market value. A week earlier in cutting meant several weeks' advance in threshing, and by avoiding wet weather and early frosts the commercial value of the grain was advanced.

Micro-Analytical Methods as Time Savers

By Professor E. M. CHAMOT

The microchemical and microscopical methods of analysis which are being developed possess such potential economic possibilities that all analysts should become familiar with them, not only because they provide means for the solution of many problems which cannot be solved by other methods, but also because they provide the most practicable way of reducing costs and of saving time in analytical and research laboratories. This article is reprinted from a recent issue of "Industrial and Engineering Chemistry."

NEITHER micro-chemical analysis nor chemical microscopy can be considered as new tools. They are new only in the sense that they are now attracting far more attention than when they were first devised and most chemists are beginning to view them from a somewhat different angle. In these methods we find new systems of procedure rather than new tools.

Chemists have, for the most part, been slow to recognise the value of micro-analytical methods because they have regarded them merely as a means for dealing with amounts of material far too small to be handled by the ordinary methods of analysis and have failed to perceive that this very fact—ability to deal with small weights and small volumes—can be taken advantage of and a mode of procedure devised whereby chemical operations can be greatly expedited. Since the weights and the volumes of reacting compounds are reduced to a minimum, the sizes of the utensils required for carrying on the various operations are correspondingly reduced and the space necessary for a set-up is small indeed compared with that which is essential when standard methods are employed. It follows that time and labour are saved and costs greatly diminished. The economies which can thus be brought about are often of a startling nature, especially where rare and expensive materials or reagents are involved or when the preparation of a suitable sample is a time-consuming task.

For the information of those who have not yet looked into the merits of micro-analytical methods, it can be asserted that substantially all standard methods of quantitative analysis can be so modified as to be made applicable to the analysis of very small amounts of material with no appreciable increase in error. What is essential, however, is that the analyst must be a good manipulator and have dexterity and patience as well as steady nerves. In other words, he must be a good analyst. Handling the delicate, fragile utensils and apparatus and supersensitive instruments is no job for a clumsy, careless, or impatient chemist. There is nothing inherently difficult in these methods and nothing which should bar them from any well-conducted laboratory, for the requisite manipulative technique is easily acquired.

Errors in Sampling

Micro-quantitative methods are available for inorganic as well as for organic compounds, although the latter appear to be receiving more attention, probably because of Pregl's work and the fact that his book has been translated into English and is therefore well-known, whereas the contributions of Emich, Donau, and others in the field of inorganic micro-analysis are overlooked. The errors alleged to be inherent in micro-sampling are of no greater relative magnitude than those to be found in our macroscopic methods. If the sampling is performed under a low-power microscope the accuracy is certainly in favour of the micro-methods, for the microscope is almost certain to reveal any non-homogeneity in the material in question. Moreover, because of the rapidity with which analyses can be made and their very low costs, more samples can be analysed in less time and there is less temptation to shirk. Thus any errors in sampling and any non-uniformity in the material are more likely to be brought to light.

These micro-analytical methods differ from our so-called standard methods of quantitative analysis in substantially one particular only—they deal with very small amounts of material. The basic principles involved and the reagents employed are the same as when large samples are treated, but it is coming to be generally accepted that the term "micro-chemical" should be restricted to methods in which about 10 mg. of sample are treated and a micro-balance employed. When the weight of the sample approximates 50 mg., the method becomes "semi-micro," and an ordinary sensitive analytical balance can be employed. These semi-micro-methods are especially well suited to industrial control laboratories where speed is essential and the lowering of costs desirable.

Advantages of Microscopical Methods

There is a phase of micro-analysis in which our procedures are radically different from those which we term chemical methods. This is a field quite apart and one which is sadly neglected, namely, microscopical quantitative analysis. While I recognise the importance of micro-chemical analyses and can fully appraise their value both in industry and in research, I am nevertheless firmly convinced that microscopical methods offer even greater possibilities in the matter of time- and labour-saving. Any competent analyst trained in the use of the microscope can devise new procedures, new tests, and new applications for chemical microscopy.

Chemical microscopical methods are applicable to synthetical as well as analytical studies. In the former cases, the rate of formation and change of character or the transformation of a compound can often be followed, and much new light can thus be thrown upon a process and possibilities of improvement revealed, facts which could not readily have been brought to light by other means. Studies of relative solubilities are best made with the microscope. Neither high magnifications nor elaborate instruments are essential for the study of the great majority of problems arising in chemical laboratories. Unlike those methods which we have considered above and which are of general applicability, microscopical quantitative analyses are restricted to certain specific types of material. They were originally devised to enable the analyst to determine the probable percentage composition of materials not susceptible of analysis by ordinary chemical methods—for example, mixtures of starches, meals, crude drugs, paper pulps, textile fibres, rocks, etc. They are by no means restricted, however, to such materials, and are now being applied with great success to ceramic materials, cements, mortars, mixtures of powdered minerals and ores, percussion powders and other explosives, alloys, etc. That is, their special field is the analysis of heterogeneous mixtures of materials of complex chemical composition.

Necessary Requirements of the Sample

Microscopical quantitative analyses can be successfully applied to any materials provided (1) the components of the mixture differ sufficiently in appearance to permit easy recognition under the microscope or are susceptible of being rendered different; (2) the different components bear a reasonably constant relationship to the physical and chemical properties; (3) the specific gravities of the components is nearly the same, or known; and (4) the sample is representative of the material.

In general, but little preparation of the sample is required when it is in the form of a powder. The chief difficulty lies in obtaining a uniform distribution of the particles in a suitable mounting medium upon an object slide. Alloys must be surfaced and etched. Fragmental materials can be embedded and sectioned or surfaced. The ratios of components are determined by comparison with standards, by counts of particles, by the sum of the intercepts along a given line across the field of the microscope, by the use of a reference substance, or by measuring the areas of the different fragments in a suitably prepared section. The counting of the different components is greatly facilitated by judicious selection of a mounting medium of the proper refractive index, or by counts or comparisons made between crossed nicols.

Microscopical methods of quantitative analysis are worthy of far more attention of chemists than they have received, for in the majority of cases these methods are capable of yielding results with great rapidity and at substantially no cost for reagents and with the expenditure of but little labour. But the analyst must acquire the requisite microscopical tech-

nique and learn to illuminate his preparations properly and interpret the images which he sees when looking into his microscope, images obtained with polarised light or with ultra-violet light, as well as with ordinary light.

Microscopical qualitative analysis no longer requires any propaganda in its behalf, for it has come to be accepted in most laboratories as a most welcome substitute for the less rapid, less easily interpreted and far more costly chemical methods. Although the recognition of cations and anions is a comparatively simple matter, the identification of compounds usually calls for a rather comprehensive knowledge of optical crystallography, a knowledge which unfortunately is seldom acquired by the chemist. This, in a way, is a new tool for the chemist and it is quite important that he possess it if he is to make full use of the polarising microscope in the solution of the intricate problems arising in his investigations. This is especially true if his field is organic chemistry or in the borderland between chemistry and biology.

Pharmaceutical Chemicals in Japan

The Market for British Products

OWING to the system of classification employed by the Japanese customs authorities in recording imports of chemicals generally, accurate totals of the imports of pharmaceutical chemicals and preparations are not available. It is estimated, however, that for 1930 the production and consumption of drugs and medicines is about Yen 100,000,000 (approximately £9,800,000) and the value of imported material is about 25 per cent. of this figure.

According to a report issued by the Department of Overseas Trade to firms whose names are entered upon the special information service register, there is no particular prejudice in Japan against British pharmaceutical chemicals. Owing to the phenomenal Japanese demand for patent medicines, the demand for those pharmaceutical chemicals of which they are composed is equally great. Imports shown separately in the Customs returns include liquorice, cinchona bark, gelatine, boric acid, tartaric acid, salicylic acid, acetylsalicylic acid, carbolic acid, bicarbonate of soda, borate of soda, cyanide of soda and potash, chlorate of potash, bichromate of soda, chloride of ammonium, carbonate of ammonium, glycerine, antipyrin, pyramidon, quinine, casein, alcoholic medicinal preparations, aromatic chemicals, opium, citric acid, morphine, cocaine, diacetylmorphine and formalin. Imports from the United Kingdom comprise all pharmaceutical chemicals excepting liquorice, pyramidon, quinine, opium, morphine, cocaine and diacetylmorphine.

Future Outlooks for British Products

The United Kingdom takes the lead in imports of boric acid, carbolic acid, cyanide of soda and potash, and alcoholic medicinal preparations; and comes second in imports of chloride of ammonium, carbonate of ammonium and glycerine, and takes a large share in those of tartaric acid and citric acid. Imports which show prospects of increasing are sandalwood oil, lactose, boric acid, borax, liquid paraffin, codeine phosphate, crude cresol, vaseline, hydrogen peroxide, cacao fat, glycerine, cream of tartar, phenacetine, potassium bromide, sodium bromide, liquorice, cinchona bark, pyramidon, gentian root, cassia and cinnamon bark, salvarsan, tartar emetic, glue capsules, potassium chlorate, quinine hydrochloride and aspirin, but in the case of boric acid, borax (for industrial purposes), codeine phosphate, crude cresol, glycerine, cream of tartar and potassium chlorate, the British share which shows prospects of increasing is small. British chloroform is in good demand, but this demand is expected to remain steady rather than increase.

Judged from the standpoint of their present share in the market, the outlook for British pharmaceutical chemicals is not encouraging. Since, however, the market for imported pharmaceutical chemicals in general is still fair, it might be supposed that even though Britain's present share is small there is room for expansion at the expense of her foreign rivals. This is undoubtedly true, but such expansion can only be accomplished at a price, for the disadvantages under which British pharmaceutical chemicals labour are heavy. In the first place there is the formidable German tradition to contend with. For many years following Japan's adoption of Western medicinal science medical students almost invariably studied in Germany. The students of that day became in the Japanese medical colleges which were subsequently established, the teachers of the next, so that the German influence upon their own training was projected into the training of later generations, and this influence has been steadily maintained. This invaluable tradition the Germans have in no way abused. They appear to be fully conscious of the necessity of maintaining a reputation which has been worthily established, and upon the firm foundation of their medical tradition they have built up an enviable organisation, which they spare no trouble in maintaining and fortifying by the low price which they couple with high quality, by the care and skill which they bestow upon packing, by the forethought which they show in attaching to their preparations labels and directions in the Japanese language, by their clever and extensive advertising and finally by their providing for direct representation on the spot.

Means for Assisting Sales in Japan

In addition to the handicaps of the German tradition, of price, of inadequate advertisement and of the lack of influential representation, British pharmaceutical preparations, while excellent in quality, suffer, with a few brilliant exceptions, which should be left as they are, from the further handicap of indifferent packing and poor "get-up." American goods usually sell themselves on attractive "get-up" which suggests quality, while British goods have to be sold by the selling ability and effort of the salesman. This is a point which should be carefully studied. The Japanese man in the street is temperamentally attracted by colour and form and by a general appearance of gaiety and novel design. The same preparation can be sold widely and profitably with an attractive wrapper that can hardly be sold without.

The Acting Consul at Tokyo makes the suggestive comment that "it greatly facilitates the ultimate sales to the customer, and acts as a valuable advertisement, if Japanese labels and working instructions be supplied with the goods as a matter of course. Most German firms do this. Incidentally it should be noted that the metric system is generally used in scientific and medical circles in Japan, and working directions, tables, etc., are likely to prove more acceptable if made up on a metric basis." The importance of the two requirements last-mentioned it would be difficult to emphasise too strongly. While there are nearly 300 concerns in the pharmaceutical chemical and preparation manufacturing industry, the greater number of these are to be found in Tokyo and Osaka, and a number of large-scale manufacturers scarcely exceeds a dozen. Reference should be made to the scheme advocated by the Ministry of Home Affairs for popularising pharmaceutical chemicals produced in Japan to compete with similar preparations imported from abroad. Import duties on different pharmaceutical chemicals vary considerably. On compounds or preparations of drugs, chemicals and medicines generally, the duty is 30 per cent. *ad valorem*. No special difficulties are experienced in respect of Customs regulations.

Sugar as a Lubricant

A SUBSTITUTE for lubricating oil may be made from a mixture of sugar and water, in the proportions of 60 per cent. and 40 per cent., according to a Belgian representative at the International Sugar Council meeting in Paris. This had been used experimentally in a Belgian factory and had proved adaptable as a lubricant. There is a surplus of more than 2,000,000 tons of sugar, and new methods of employing it would be welcome.

British Overseas Chemical Trade in April

50 per cent. Decrease in Imports

Exports of chemicals, drugs, dyes and colours during April amounted to a total of £1,634,568, being £35,144 higher than the figures for April, 1931. Imports totalling £567,793 were lower by £574,393, and re-exports totalling £39,535 were lower by £294,554, as compared with April, 1931.

	Quantities. Month ended April 30. 1931.	1932.	Value. Month ended April 30. 1931. £	1932. £
Imports				
Acetic Anhydride .. cwt.	58	449	183	1,340
Acid, Acetic .. tons	819	431	30,023	14,874
Acid, Tartaric, including Tartrates .. cwt.	4,352	634	17,597	1,225
Bleaching Material ,,	10,258	3,829	20,700	1,595
Borax .. .. ,,	15,725	24,771	9,463	12,528
Calcium Carbide .. ,,	98,727	42,944	61,035	26,754
Coal Tar Products, not elsewhere specified value	—	—	70,914	414
Glycerine, Crude .. cwt.	120	—	219	—
Glycerine, Distilled ,,	1,376	5	2,838	15
Red Lead and Orange Lead .. .. ,,	934	120	1,398	149
Nickel Oxide .. ,,	—	75	—	334
Potassium Nitrate (Saltpetre) .. .. cwt.	5,780	17,045	5,066	8,621
Other Potassium Compounds .. .. cwt.	357,334	107,489	105,347	44,682
Sodium Nitrate .. ,,	169,362	—	73,695	—
Other Sodium Compounds cwt.	28,490	17,272	19,738	12,578
Tartar, Cream of .. ,,	1,230	63	4,960	241
Zinc Oxide .. tons	640	73	14,710	2,305
Other Chemical Manufactures .. .. value	—	—	253,706	187,783
Quinine and Quinine Salts oz.	104,545	45	7,516	2
Bark Cinchona (Bark Peruvian), etc. .. cwt.	1,135	242	4,947	1,204
Other Drugs .. value	—	—	129,474	74,331
Intermediate Coal Tar Products .. cwt.	83	21	991	226
Alizarine and Alizarine Red .. .. cwt.	46	—	1,899	—
Indigo, Synthetic ,,	—	—	—	—
Other Dyestuffs .. ,,	3,793	3,083	87,290	63,045
Cutch .. .. ,,	4,203	1,433	8,301	1,645
Other Extracts for Dyeing ,,	1,141	919	3,101	3,565
Indigo, Natural .. ,,	—	2	—	48
Extracts for Tanning ,,	80,950	35,938	77,199	33,143
Barytes, Ground .. ,,	35,689	14,427	7,149	2,997
White Lead (dry) ,,	11,238	3,714	15,795	5,148
Other painters' colours and materials .. cwt.	92,318	47,058	106,932	67,001
TOTAL .. value	—	—	1,142,186	567,793
Exports				
Acid, Sulphuric .. cwt.	7,033	5,435	2,306	3,097
Acid, Tartaric, including Tartrates, .. cwt.	1,157	695	6,190	5,065
Ammonium Chloride (Muriate) .. tons	465	287	7,531	5,664
Ammonium Sulphate ,,	37,508	33,916	268,760	179,903
Bleaching Powder (Chloride of Lime) .. cwt.	20,338	47,995	6,589	14,338
COAL TAR PRODUCTS—				
Anthracene .. cwt.	—	—	—	—
Benzol and Toluol galls.	5,074	21,948	424	2,181
Carbolic Acid (Crude)	1,550 gals.	1,593 gals.	338	185
Carbolic Acid (Crystals) cwt.	979	1,089	2,571	3,234
Cresylic Acid .. galls.	118,021	83,229	12,861	9,123
Naphtha .. ,,	4,713	1,363	408	128
Naphthalene (excluding Naphthalene Oil) cwt.	839	12,930	475	3,497
Tar Oil, Creosote Oil, etc. .. .. galls.	625,104	1,387,908	7,585	31,663
Other sorts .. cwt.	15,847	49,683	7,452	14,856
COAL TAR PRODUCTS	—	—	32,114	64,867
Copper, Sulphate of tons	8,510	7,755	160,891	146,494
Disinfectants, Insecticides, etc. .. .. cwt.	27,306	35,030	58,620	73,080
Glycerine, Crude .. cwt.	2,530	6,683	2,976	11,986
Glycerine, Distilled ,,	6,721	7,448	16,580	16,480
Potassium Chromate and Bichromate .. cwt.	1,043	1,579	2,465	3,797
Potassium Nitrate (Saltpetre) .. .. ,,	1,060	1,932	1,811	3,262
Other Potassium Compounds .. .. cwt.	3,859	2,398	7,360	7,523
Sodium Carbonate, including Crystals, Ash and Bicarbonate .. cwt.	382,824	322,249	100,515	83,299
Caustic Soda .. ,,	161,954	126,262	101,787	90,564
Sodium Chromate and Bichromate .. cwt.	2,576	1,953	4,266	3,814
Sodium Sulphate, including Salt Cake .. cwt.	6,176	10,268	1,356	2,522
Other Sodium Compounds cwt.	46,439	72,381	66,954	75,526
Zinc Oxide .. tons	254	1,094	6,091	20,985
Other Chemical Manufactures .. .. value	—	—	229,070	262,141
Quinine and Quinine Salts oz.	130,625	75,361	13,234	9,418
Other Drugs .. value	—	—	205,259	226,589
Dyes and Dye-stuffs (Coal Tar) .. .. cwt.	7,899	9,718	84,060	90,063
Other Dyestuffs .. ,,	4,000	10,909	4,123	12,136
Barytes, Ground .. cwt.	2,410	1,355	1,129	768
White Lead (dry) ,,	1,327	1,737	2,356	3,162
Paints and Colours in paste form .. .. cwt.	22,349	22,272	41,341	39,400
Paints and Enamels, prepared .. .. cwt.	32,609	35,280	96,036	105,889
Other painters' colours and materials .. cwt.	37,682	41,887	67,654	72,736
TOTAL .. value	—	—	1,599,424	1,634,568
Re-Exports				
Acid, Tartaric, including Tartrates .. cwt.	89	48	555	326
Borax .. .. ,,	273	154	152	105
Coal Tar Products, not elsewhere specified value	—	—	7	4
Potassium Nitrate (Saltpetre) .. .. cwt.	144	76	120	123
Sodium Nitrate .. ,,	3,109	5,341	1,455	2,548
Tartar, Cream of .. ,,	224	308	1,022	1,250
Other Chemical Manufactures .. .. value	—	—	6,410	8,953
Quinine and Quinine Salts oz.	3,486	4,238	349	632
Bark Cinchona (Bark Peruvian, etc.) .. cwt.	315	256	2,552	2,064
Other Drugs .. value	—	—	312,178	20,053
Cutch .. .. cwt.	2,670	508	4,071	619
Other Extracts for Dyeing cwt.	137	52	847	253
Indigo, Natural .. ,,	—	6	—	178
Extracts for tanning ,,	1,555	228	1,983	323
Painters' Colours and materials .. .. cwt.	354	783	1,333	1,905
TOTAL .. value	—	—	334,089	39,535

Swiss Import Decision

DRASTIC import restrictions have been decided on by the Swiss Federal Council. All categories of cereals, maize, malt, coffee, sugar, coal, petrol, benzol and the products of distillation of petrol, and oils of other kinds are included in the restrictions.

News from the Allied Industries

Non-Ferrous Metals

SOVIET RUSSIA'S large aluminium mill at Leningrad, the construction of which began on July 3, 1930, has now started working and has produced the first Soviet aluminium.

Sugar Industry

THOUSANDS OF SACKS were involved in a fierce fire which occurred in a large corrugated iron building on the premises of Tate and Lyle, Ltd., sugar refiners, at North Woolwich, on May 16. The fire, which was discovered just after 8 a.m., was under control after several hours' strenuous work by the West Ham Brigade. The building, which was used as a sack store and is some distance from the main factory, was extensively damaged.

Soap Manufacture

THOMAS HEDLEY AND CO., LTD., of Newcastle, have announced that they have decided to build a new and up-to-date soapworks at Trafford Park. The management considers the Trafford Park site a good one, not only because it is served by both rail and water but because it is the centre of a very largely populated area. The firm was founded by the late Alderman Thomas Hedley in 1837, and manufactures all types of soaps and candles, in addition to main proprietary bars.

Whale Oil

NEGOTIATIONS FOR THE REGULATION of whale oil production during the season 1932-33, and the partial employment of the great Norwegian whaling fleet, which lay idle last season, were concluded at a meeting of representatives of whaling companies affiliated to the Whaling Association, held at Sandefjord, on May 13. The British whaling firm, Chr. Salvesen and Co., of Leith, were among the foreign firms represented at the meeting and accepted the draft agreement. The draft will be submitted to all the companies represented, and replies must be received by June 6.

Match Industry

AN OPTIMISTIC VIEW OF THE NEGOTIATIONS concerning the Swedish Match Co. was taken by M. Bjorn Prytz, a member of the Kreuger Investigation Commission, in a press interview while on his way to Stockholm from Paris. He declared that the negotiations were proceeding favourably, and that there were good prospects of obtaining extensive long-term loans in France, with America participating. It was claimed as a condition of these loans that a syndicate of Swedish banks should provide a guarantee. He expected that the negotiation in Paris would be definitely concluded this week, and he hoped they would assure the reconstruction of the Swedish Match Company.

M. Fredrik Ljungberg, chairman of Trummer and Co., of London, and M. Gabrielsson, of Gothenburg, have been offered the posts of co-directors of the Swedish Match Co., according to the "Svenska Dagbladet."

Tanning Industry

THERE is great activity at present in the gloving trade. The tariff has given just that necessary security to enable the Yeovil glovers to go ahead. There is a scarcity of glove cutters and overtime is frequent. The dressers of gloving leathers are busy and are developing many new lines. Beside the usual suede leathers and capes, a fine imitation nappa leather is being manufactured from Indian and domestic sheep. These are now being more and more finished off with pigment finishes, both water and cellulose. There are openings for manufacturers of solvents, ketones, esters, and similar products among the glove leather dressers for use in conjunction with the cellulose finishes. Chrome and semichrome leather manufacturers are experiencing a slow but gradual increase in the demand for their productions. Many of these tanners make their own chrome tanning liquors but an ever increasing number of them is buying ready-made liquors. There are signs too that they are growing weary of the constant stream of cheap sulphonated oils and there is scope for a properly made and scientifically controlled production.

Mineral Oil

REFERRING TO RECENT REPORTS that the European interests of the Pan American Petroleum and Transport Company are being acquired by the Standard Oil Co., of New Jersey, the Petroleum Storage and Finance Corporation informs shareholders, in a circular, in view of its contractual association with Pan American, that their interests are protected in the event of such a change.

Iron and Steel

THE BARROW HEMATITE STEEL CO., LTD., have restarted their ironworks, two furnaces being put into blast on Monday, May 16. These furnaces have been idle since last February owing to the small demand for iron and the heavy stock of iron held. These stocks of iron have been considerably reduced, and there is also now a local outlet for Barrow iron, for the rail departments of the company will shortly resume operations.

China Clay

THE BOARD OF TRADE RETURNS for April show that 35,095 tons of china clay was exported from Great Britain during the month, as against 37,632 tons for the corresponding month of 1931. The value shown in the returns was £53,864, as against £68,143. For the first four months of the year the total was 121,431 tons, valued at £196,734, as against 127,017 tons, valued at £231,570, for the first four months of last year. No particulars are given with regard to imports during the month.

Paper Making

THE VEGETABLE PARCHMENT ENTERPRISE in the British paper industry is progressing. One mill on the Thames has an eye very wide open for expansion, and has recently completed the erection of a new parchment machine. The output of this mill will now be 10,000 tons per annum. The estimated home consumption of vegetable parchment is roughly 7,000 tons per annum, so that the balance is presumably available for export. This mill has facilities for further increasing their output by 2,500 tons, should there be any signs of the demand increasing.

Rubber

MERSEYSIDE is reported to be satisfied with the fact that the port's claims to the rubber trade are being increasingly recognised over those of London. A representative of Henry Diaper and Co., who hold about one-third of the Liverpool stocks of raw rubber, said to-day that for the last eighteen months stocks had been increasing in Liverpool and decreasing slightly in London. Liverpool was infinitely more centralised for the distribution of the rubber to the chief manufacturers, and in the transport from the warehouses there was considerable saving.

THE SPEECH OF SIR ERIC GEDDES at the general meeting of the Dunlop Rubber Co., on May 11, dealt partly with the general economic conditions of this country and the world, and partly with the progress which the Dunlop Company is making in those conditions. It is clear that the board is not yet looking for any great general improvement, but that it has some hopes of Ottawa and the new tariff so far as this country and the Empire are concerned. Against this background, though independently of it, the chairman has moderately good expectations of his company in 1932. In the report the directors spoke of a probable improvement this year. The chairman explained that that prediction represented no more than the best judgment of the board in all the circumstances; but, from the fact that he immediately went on to speak of the economies which have been secured and of the ample provision for bad debts, stock losses and the like, it may be assumed that the prediction was made on the soundest basis for such estimates—anticipated expenditure, rather than anticipated sales. Shareholders may therefore suppose that, if during the rest of the year general conditions do not get seriously worse, the profits of the company will be fully maintained at least at the 1931 level, and possibly higher.

Weekly Prices of British Chemical Products

Review of Current Market Conditions

The following notes on the chemical market conditions in Great Britain are based on direct information supplied by the British manufacturers concerned, and unless otherwise qualified the figures quoted apply to fair quantities, net and naked at makers' works. Where no locality is indicated, the prices are general for the United Kingdom. Particulars of the London chemical market are specially supplied to THE CHEMICAL AGE by R. W. Greeff and Co., Ltd., and Chas. Page and Co., Ltd., and those of the Scottish chemical market by Chas. Tennant and Co., Ltd.

THE Whitsun holiday has naturally interfered with the demand for chemical products and only small business has been placed in London during the week for buyers' immediate requirements. Markets on the whole continue steady. The market for coal tar products is unchanged. Conditions in the Manchester chemical market during the past week have been very much quieter than usual in consequence of the Whitsun holidays. Actual new business that has been reported has been of very small dimensions, and with many of the consuming establishments in Lancashire and Yorkshire closed down for varying periods deliveries of many descriptions of chemicals against existing commitments have been interfered with seriously. For the reason that the majority of market values have not been tested since last report very few price changes fall to be recorded this week. Business in the Scottish market shows signs of improvement, but quantities are still small.

General Chemicals

ACETONE.—LONDON: £65 to £68 per ton; SCOTLAND: £66 to £68 ex wharf, according to quantity.

ACID, ACETIC.—Tech. 80%, £37 5s. to £39 5s.; pure 80% £38 5s. to £40 5s.; tech., 40%, £19 15s. to £21 15s.; tech., 60%, £28 10s. to £30 10s. SCOTLAND: Glacial 98/100%, £48 to £50; pure 80%, £38 5s.; tech. 80%, £37 5s. d/d buyers' premises Great Britain. MANCHESTER: 80%, commercial, £39; tech. glacial, £52.

ACID, BORIC.—SCOTLAND: Granulated commercial, £26 10s. per ton; B.P. crystals, £35 10s.; B.P. powder, £36 10s. in 1-cwt. bags d/d free Great Britain in one-ton lots upwards.

ACID, CHROMIC.—11d. per lb., less 2½% d/d U.K.

ACID, CITRIC.—1s. 1d. per lb. LONDON: 1s. 1d., less 5%. MANCHESTER: 1s. 1¼d.

ACID, CRESYLIC.—97/99%, 1s. 7d. to 1s. 9d. per gal.; 99/100%, 1s. 10d. to 2s.

ACID FORMIC.—LONDON: £50 per ton. *£52.

ACID, HYDROCHLORIC.—Spot, 3s. 9d. to 6s. carboy d/d according to purity, strength and locality. SCOTLAND: Arsenical quality, 4s.; dearsenicated, 5s. ex works, full wagon loads.

ACID, LACTIC.—LANCASHIRE: Dark tech., 50% by vol., £23 10s. per ton; 50% by weight, £27 10s.; pale tech., 50% by vol., £27; 50% by weight, £32; 80% by weight, £52; edible, 50% by vol., £40. One-ton lots ex works, barrels free.

ACID, NITRIC.—80° Tw. spot, £20 to £25 per ton makers' works, according to district and quality. SCOTLAND: 80°, £23 ex station full truck loads.

ACID, OXALIC.—LONDON: £47 per ton in casks, £48 10s. in kegs. *£49. SCOTLAND: 98/100%, £50 to £53 ex store. MANCHESTER: £2 7s. 6d. per cwt., ex store.

ACID, SULPHURIC.—Average prices f.o.r. British makers' works, with slight variations owing to local considerations: 140° Tw. crude acid, £3 per ton; 168° Tw. arsenical £5 10s.; 168° Tw. non-arsenical, £6 15s. SCOTLAND: 144° quality, £3 12s. 6d.; 168°, £7; dearsenicated, 20s. per ton extra.

ACID, TARTARIC.—1s. 0½d. per lb. SCOTLAND: B.P. crystals, 1s. 1¾d. to 1s. 2d. less 5% carriage paid. MANCHESTER: 1s. 0½d.

ALUM.—SCOTLAND: Lump potash, £9 per ton ex store.

ALUMINA SULPHATE.—LONDON: £8 5s. to £9 10s. per ton according to quality and quantity. *£7 10s. SCOTLAND: £8 to £8 10s. ex store.

AMMONIA, ANHYDROUS.—Spot, 10d. per lb. d/d in cylinders. SCOTLAND: 10d. to 1s. containers extra and returnable.

AMMONIA, LIQUID.—SCOTLAND: 80°, 2½d. to 3d. per lb. d/d, according to quantity.

AMMONIUM CARBONATE.—SCOTLAND: Lump, £36 per ton; powdered, £38, in 5-cwt. casks d/d U.K. stations or f.o.b. U.K. ports.

AMMONIUM CHLORIDE.—£37 to £45 per ton, carriage paid. LONDON: Fine white crystals, £19 to £20. (See also Salammoniac.)

AMMONIUM CHLORIDE (MURIATE).—SCOTLAND: British dog tooth crystals, £32 to £35 per ton, carriage paid according to quantity. (See also Salammoniac.)

AMMONIUM BICHROMATE.—8d. per lb. d/d U.K.

ANTIMONY OXIDE.—SCOTLAND: Spot £27 per ton, c.i.f. U.K. ports.

ANTIMONY SULPHIDE.—Golden 6½d. to 1s. 1½d. per lb.; crimson, 1s. 4d. to 1s. 6d. per lb. according to quality.

ARSENIC.—LONDON: £24 10s. c.i.f. main U.K. ports for imported material; Cornish nominal, £26 10s. f.o.r. mines. SCOTLAND: White powdered £27 ex wharf; spot, £27 10s. ex store. MANCHESTER: White powdered Cornish, £27 at mines.

ARSENIC SULPHIDE.—Yellow 1s. 6d. to 1s. 8d. per lb.

BARIUM CHLORIDE.—£11 to £11 10s. per ton.

BISULPHIDE OF LIME.—£7 10s. per ton f.o.r. London, packages free.

BLEACHING POWDER.—Spot 35/37% £7 10s. per ton d/d station in casks, special terms for contract. SCOTLAND: £8 15s. in 5/6 cwt. casks.

BORAX, COMMERCIAL.—Granulated £15 10s. per ton, powder £17, packed in 1-cwt. bags, carriage paid any station Great Britain. Prices are for 1-ton lots and upwards.

CADMIUM SULPHIDE.—3s. 6d. to 3s. 9d. per lb.

CALCIUM CHLORIDE.—Solid 70/75% spot £5 5s. to £5 15s. per ton d/d station in drums. SCOTLAND: £5 5s. to £5 15s., according to quantity and point of delivery.

CARBON BISULPHIDE.—£30 to £32 per ton, drums extra.

CARBON BLACK.—4½d. to 5½d. per lb., ex wharf.

CARBON TETRACHLORIDE.—£45 to £55 per ton, drums extra.

CHROMIUM OXIDE.—10d. to 10½d. per lb. according to quantity d/d U.K. Green 1s. 2d. per lb.

CHROMETAN.—Crystals 3¾d. per lb. Liquor £19 per ton d/d.

COPPERAS (GREEN).—SCOTLAND: £3 15s. per ton, f.o.r., or ex works.

CREAM OF TARTAR.—LONDON: £5 2s. 6d. to £5 3s. 6d. per cwt.

FORMALDEHYDE.—LONDON: £28 to £28 10s. per ton. *£30. SCOTLAND: 40%, £28 10s. ex store.

HYDROGEN PEROXIDE.—LONDON: *100 vols. 10d. per lb.

LAMPBLACK.—£46 to £50 per ton.

LEAD ACETATE.—LONDON: White, £40 to £42 per ton. Brown £1 per ton less. *£40 and £39 respectively ex wharf London. SCOTLAND: White Crystals £42 to £44 c.i.f. U.K. ports. Brown £1 per ton less. MANCHESTER: White, £36 10s.; Brown, £35.

LEAD, NITRATE.—£28 10s. to £29 per ton.

LEAD, RED.—SCOTLAND: £28 10s. per ton d/d buyer's works.

LEAD, WHITE.—SCOTLAND: £40 per ton carriage paid.

LITHOPONE.—30%, £20 to £22 per ton.

MAGNESITE.—SCOTLAND: Ground Calcined £9 per ton ex store.

METHYLATED SPIRIT.—61 O.P. Industrial 1s. 8d. to 2s. 3d. gal. Pyridinised Industrial, 1s. 10d. to 2s. 5d. Mineralised, 2s. 9d. to 3s. 3d. 64 O.P. 1d. extra in all cases. Prices according to quantities. SCOTLAND: Industrial 64 O.P., 1s. 8d. to 2s. 3d.

NICKEL AMMONIUM SULPHATE.—£38 per ton d/d.

NICKEL SULPHATE.—£38 per ton d/d.

POTASH, CAUSTIC.—£30 to £33 per ton. LONDON and MANCHESTER: £42.

POTASSIUM BICHROMATE.—Crystals and Granular, 5d. per lb. net d/d U.K. Discount according to quantity. Ground 5¾d. LONDON: 5d. per lb. with usual discounts for contracts. SCOTLAND: 5d. d/d U.K. or c.i.f. Irish Ports with allowance for contracts. MANCHESTER: 5d.

POTASSIUM CARBONATE.—SCOTLAND: 96/98% spot £28 per ton ex store. LONDON: £31 10s. to £32. MANCHESTER: £31 to £32.

POTASSIUM CHLORATE.—3¾d. per lb. export London in 1-cwt. kegs. LONDON: £37 to £40 per ton. SCOTLAND: 99¾/100% powder, £34. MANCHESTER: £36.

POTASSIUM CHROMATE.—6½d. per lb. d/d U.K.

POTASSIUM NITRATE.—SCOTLAND: Refined Granulated £28 per ton c.i.f U.K. ports. Spot £30 per ton ex store.

POTASSIUM PERMANGANATE.—LONDON: 8¾d. to 9d. per lb. SCOTLAND: B.P. crystals, 8¾d. MANCHESTER: Commercial, 8¼d.; B.P., 8¾d.

POTASSIUM PRUSSIATE.—LONDON: 8½d. to 9d. per lb. SCOTLAND: Yellow spot material, 8¼d. ex store. MANCHESTER: Yellow, 8¼d.

SALAMMONIAC.—First lump spot, £42 17s. 6d. per ton d/d in barrels.

SODA ASH.—58% spot, £6 per ton f.o.r. in bags, special terms for contracts.

SODA, CAUSTIC.—Solid 76/77° spot £14 10s. per ton d/d station. SCOTLAND: Powdered 98/99% £17 10s. in drums, £18 15s. in casks. Solid 76/77% £14 10s. in drums. 70/72% £14 12s. 6d. carriage paid buyer's station, minimum 4-ton lots; contracts 10s. per ton less. MANCHESTER: £12 15s. to £14 contracts.

SODA CRYSTALS.—Spot £5 to £5 5s. per ton d/d station or ex depot in 2-cwt. bags.

SODIUM ACETATE.—£21 to £22 per ton.

SODIUM BICARBONATE.—Refined spot £10 10s. per ton d/d station in bags. SCOTLAND: Refined recrystallised £10 10s. ex quay or station. MANCHESTER: £10 10s.

* Prices quoted by other manufacturers.

SODIUM BICHROMATE.—Crystals cake and powder 4d. per lb. net d/d U.K. discount according to quantity. Anhydrous 5d. per lb. LONDON: 4d. per lb. with discounts for quantities. SCOTLAND: 4d. delivered buyer's premises with concession for contracts. MANCHESTER: 4d. less 1 to 3½% contracts, 4d. spot lots.

SODIUM BISULPHITE POWDER.—60/62%, £16 10s. per ton d/d 1-cwt. iron drums for home trade.

SODIUM CARBONATE (SODA CRYSTALS).—SCOTLAND: £5 to £5 5s. per ton ex quay or station. Powdered or pea quality 7s. 6d. per ton extra. Light Soda Ash £7 ex quay, min. 4-ton lots with reductions for contracts.

SODIUM CHLORATE.—2⅞d. per lb. LONDON: £29 per ton. *£32 10s. MANCHESTER: £29.

SODIUM CHROMATE.—3⅝d. per lb. d/d U.K.

SODIUM HYPOSULPHITE.—SCOTLAND: Large crystals English manufacture £9 5s. per ton ex stations, min. 4-ton lots. Pea crystals £15 ex station 4-ton lots. MANCHESTER: Commercial, £9 5s.; photographic, £15.

SODIUM NITRITE.—Spot £19 to £22 per ton d/d station in drums.

SODIUM PERBORATE.—LONDON: 10d. per lb.

SODIUM PHOSPHATE.—£13 to £15 per ton f.o.r. London casks free. LONDON: Dibasic, £13 per ton. MANCHESTER: £13 10s. to £14.

SODIUM PRUSSIATE.—LONDON: 5d. to 5½d. per lb. SCOTLAND: 5d. to 5¾d. ex store. MANCHESTER: 5d. to 6d.

SODIUM SILICATE.—140° Tw. Spot £8 5s. per ton d/d station returnable drums.

SODIUM SULPHATE (GLAUBER SALTS).—£4 2s. 6d. per ton d/d. SCOTLAND: English material £3 15s.

SODIUM SULPHATE (SALT CAKE).—Unground Spot £3 15s. per ton d/d station in bulk. SCOTLAND: Ground quality, £3 5s. per ton d/d. MANCHESTER: £3 2s. 6d.

SODIUM SULPHIDE.—Solid 60/62% Spot £10 15s. per ton d/d in drums. Crystals Spot £7 15s. per ton d/d in casks. SCOTLAND: For home consumption, Solid 60/62%, £10 5s.; broken 60/62%, £11 5s.; crystals, 30/32%, £8 2s. 6d. d/d buyer's works on contract, min. 4-ton lots. Spot solid 5s. per ton extra. Crystals, 2s. 6d. per ton extra. MANCHESTER: Concentrated solid, 60/62%, £11 5s.; commercial, £8.

SODIUM SULPHITE.—Pea crystals spot, £13 10s. per ton d/d station in kegs. Commercial spot £9 10s. d/d station in bags.

SULPHATE OF COPPER.—MANCHESTER: £18 per ton f.o.b.

SULPHUR.—£12 5s. to £15 15s. per ton. SCOTLAND: Flowers, £12 10s.; roll, £12 10s.; rock, £9. Ground American, £12 ex store.

SULPHUR CHLORIDE.—5d. to 7d. per lb., according to quality.

SULPHUR PRECIP.—B.P. £55 to £60 per ton according to quantity. Commercial, £50 to £55.

VERMILION.—Pale or deep, 6s. 4d. per lb.

ZINC CHLORIDE.—SCOTLAND: British material, 98%, £18 10s. per ton f.o.b. U.K. ports.

ZINC SULPHATE.—LONDON and SCOTLAND: £12 per ton.

ZINC SULPHIDE.—1s. to 1s. 2d. per lb.

Pharmaceutical and Fine Chemicals

THE following changes in price are reported:—

PHENACETIN.—4s. 0½d. to 4s. 5d. per lb.

VANILLIN.—Clove oil, 16s. to 18s. per lb.; Guaiacol, 1s. 9d. per lb. less.

Intermediates and Dyes

IN the following list of Intermediates delivered prices include packages except where otherwise stated:—

ACID, BENZOIC, B.P. (ex Toluol).—1s. 9½d. per lb.

ACID, GAMMA.—Spot, 4s. per lb. 100% d/d buyer's works.

ACID H.—Spot, 2s. 4½d. per lb. 100% d/d buyer's works.

ACID, NEVILLE AND WINTHER.—Spot, 3s. per lb. 100% d/d buyer's works.

ACID, SULPHANILIC.—Spot, 8d. per lb. 100% d/d buyer's works.

ANILINE OIL.—Spot, 8d. per lb., drums extra, d/d buyer's works.

ANILINE SALTS.—Spot, 8d. per lb. d/d buyer's works, casks free.

BENZALDEHYDE.—Spot, 1s. 8d. per lb., packages extra.

BENZIDINE BASE.—Spot, 2s. 5d. per lb. 100% d/d buyer's works.

o-CRESOL 30/31° C.—£2 6s. 5d. per cwt., in 1-ton lots.

m-CRESOL 98/100%.—2s. 9d. per lb., in ton lots.

p-CRESOL.—34.5° C.—1s. 9d. per lb., in ton lots.

DICHLORANILINE.—2s. 2d. per lb.

DIMETHYLANILINE.—Spot, 1s. 6d. per lb., package extra.

DINITROBENZENE.—8½d. per lb.

DINITROTOLUENE.—48/50° C., 8½d. per lb.; 66/68° C., 9d. per lb.

DIPHENYLAMINE.—Spot, 2s. per lb., d/d buyer's works.

a-NAPHTHOL.—Spot, 2s. 4d. per lb., d/d buyer's works.

B-NAPHTHOL.—Spot, £75 per ton in 1-ton lots, d/d buyer's works.

a-NAPHTHYLAMINE.—Spot, 11½d. per lb., d/d buyer's works.

B-NAPHTHYLAMINE.—Spot, 2s. 9d. per lb. d/d buyer's works.

o-NITRANILINE.—5s. 10d. per lb.

m-NITRANILINE.—Spot, 2s. 7d. per lb. d/d buyer's works.

p-NITRANILINE.—Spot, 1s. 8d. per lb. d/d buyer's works.

NITROBENZENE.—Spot, 6½d. per lb.; 5-cwt. lots, drums extra.

NITRONAPHTHALENE.—9d. per lb.

SODIUM NAPHTHIONATE.—Spot, 1s. 9d. per lb.

o-TOLUIDINE.—Spot, 9½d. per lb., drums extra, d/d buyer's works.

p-TOLUIDINE.—Spot, 1s. 9d. per lb., d/d buyer's works.

m-XYLIDINE ACETATE.—3s. 6d. per lb., 100%.

Coal Tar Products

ACID, CARBOLIC (CRYSTALS).—5½d. to 6¾d. per lb. Crude, 60's 1s. 5½d. to 1s. 6¼d. per gal. SCOTLAND: Sixties, 1s. 7d. to 1s. 8d.

ACID, CRESYLIC.—99/100, 1s. 7d. per gal.; B.P., 2s. to 2s. 2d.; Refined, 1s. 9d. to 1s. 11d.; Pale, 98%, 1s. 6d. to 1s. 7d.; Dark, 1s. 4d. to 1s. 4½d. LONDON: 98/100%, 1s. 6d. Dark 95/97%, 1s. 4d. SCOTLAND: Pale 99/100%, 1s. 3½d. to 1s. 4½d.; 97/99%, 1s. 1½d. to 1s. 2½d.; dark 97/99%, 1s. 0½d. to 1s. 1½d.; high boiling acid, 2s. 6d. to 3s.

BENZOL.—At works, crude 7d. to 7½d. per gal. Standard motor, 1s. 2d. to 1s. 3d.; 90%, 1s. 3d. to 1s. 4d. Pure, 1s. 6d. to 1s. 7d. LONDON: Motor, 1s. 5½d. SCOTLAND: Motor, 1s. 3½d. to 1s. 4½d.; 90%, 1s. 9½d. to 1s. 10½d.

CREOSOTE.—Standard for export, 4¾d. to 5d. nett per gal. f.o.b. for Home, 3¾d. d/d. LONDON: 3d. to 3½d. f.o.r. North; 4d. to 4½d. London. MANCHESTER: 4d. to 5d. SCOTLAND: Specification oils, 3¾d. to 4¼d.; washed oil, 4d. to 4½d.; light, 3¾d. to 4¼d.; heavy, 4½d. to 5d.

NAPHTHA.—Solvent, 90/160, 1s. 4d. to 1s. 5d. per gal.; 95/160, 1s. 4½d.; 90/190, 1s. to 1s. 1d. LONDON: Solvent, 1s. 1½d. to 1s. 2d.; heavy, 11d. to 1s. 0½d. f.o.r. SCOTLAND: 90/160, 1s. 3d. to 1s. 3½d.; 90/190, 1s. 1d. to 1s. 2d.

NAPHTHALENE.—Purified crystals, £9 10s. per ton in bags. LONDON: Fire lighter quality, £3 to £3 10s.; 74/76 quality, £4 to £4 10s.; 76/78 quality, £5 10s. to £6. SCOTLAND: 40s. to 50s.; whizzed, 65s. to 70s.

PYRIDINE.—90/140, 3s. 9d. per gal.; 90/160, 4s. to 4s. 6d.; 90/180, 2s. to 2s. 6d. SCOTLAND: 90/160%, 4s. to 5s.; 90/220%, 3s. to 4s.

REFINED COAL TAR.—SCOTLAND: 5d. to 5¼d. per gal.

TOLUOL.—90%, 2s. 2d. per gal.; Pure, 2s. 7d.

XYLOL.—1s. 9d. per gal.; Pure, 1s. 11d.

Wood Distillation Products

ACETATE OF LIME.—Brown, £8 per ton. Grey, £12. Liquor, 8d. to 9d. per gal. MANCHESTER: Brown, £7 5s.; grey, £11.

ACETIC ACID, TECHNICAL, 40%.—£16 15s. to £17 15s. per ton.

ACETONE.—£63 to £65 per ton.

AMYL ACETATE, TECHNICAL.—95s. to 100s. per cwt.

CHARCOAL.—£7 10s. to £11 per ton.

IRON LIQUOR.—24°/30° Tw., 10d. to 1s. 2d. per gal.

WOOD CREOSOTE.—1s. to 2s. 6d. per gal., unrefined.

WOOD NAPHTHA, MISCIBLE.—3s. to 4s. per gal. Solvent, 3s. 9d. to 4s. 9d. per gal.

WOOD TAR.—£2 10s. to £6 per ton.

BROWN SUGAR OF LEAD.—£32 per ton.

Latest Oil Prices

LONDON, May 18.—LINSEED OIL was slow. Spot (small quantities), £16; May, £13; June-Aug., £13 5s.; Sept.-Dec., £14; Jan.-April, £15 per ton, naked. RAPE OIL was slow. Crude extracted, £28 10s.; technical refined, £30 10s. per ton, naked, ex wharf. COTTON OIL was quiet. Egyptian crude, £19; refined common edible, £22; and deodorised, £24 per ton, naked, ex mill. TURPENTINE was steady. American, spot, 58s. 3d.; June, 57s. 6d. per cwt.

HULL.—LINSEED OIL.—Spot, £13 2s. 6d.; May at £12 10s.; June at £12 15s.; July-Aug. at £13; Sept.-Dec. at £13 7s. 6d.; and Jan.-April at £14 2s. 6d. per ton. COTTON OIL.—Egyptian crude, spot, £19; edible, refined, and technical, spot, £20 10s.; deodorised, £23 10s. per ton, naked. PALM KERNEL OIL.—Crude, f.m.q., spot, £22 per ton, naked. GROUNDNUT OIL.—Crushed extracted, spot, £32 10s.; deodorised, £36 10s. per ton.—RAPE OIL.—crushed extracted, spot, £27 10s.; refined, £29 per ton. SOYA OIL.—Crushed extracted, spot, £20; deodorised, £23 per ton. COD OIL, 17s. per cwt. CASTOR OIL.—Pharmacy, spot, 42s. 6d.; first, 37s. 6d.; second, 32s. 6d. per cwt. TURENTINE.—American, spot, 58s. per cwt.

Nitrogen Fertilisers

SULPHATE OF AMMONIA.—*Export.*—The market has continued weak, and the price is now about £4 7s. 6d. per ton f.o.b. U.K. port in single bags. *Home.*—In the South of England offers have been made at £5 15s. per ton, delivered in 6-ton lots to consumers' nearest stations, but in the north, where the season is later, the prevailing price appears to be £6 5s.

NITRATE OF SODA.—There is nothing further to report, with regard to imported material, and the British price remains unchanged.

NITRO-CHALK.—The price remains unchanged at £7 5s. per ton, in 6-ton lots, delivered to consumers' nearest stations, but the demand appears to be quieter.

* Prices quoted by other manufacturers.

Inventions in the Chemical Industry

Specifications Accepted and Applications for Patents

THE following information is prepared from the Official Journal (Patents) by permission of the Controller to H.M. Stationery Office. Printed copies of full Patent Specifications accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given in "Specifications Accepted" are those under which the specifications are printed. Abridgments of "Complete Specifications open to Public Inspection" will not be published until they have been accepted or the applications have become void. The dates given are those claimed under the International Convention. The numbers in "Applications for Patents" are for reference in all correspondence up to the acceptance of the complete specifications. In the case of applications for patents under the International Convention, the priority date (that is, the original application date abroad which the applicant desires shall be accorded to the patent) is given in brackets, with the name of the country of origin. Specifications of such applications are open to inspection at the Patent Office on the anniversary of the date given in brackets, whether or not they have been accepted.

Specifications Accepted with Date of Application

MANUFACTURE OF CELLULOSE ESTERS. Dr. A. Wacker Ges für Elektro-Chemische Industrie Ges. Dec. 18, 1930. 372,241.

PROCESS FOR THE MANUFACTURE OF N-ALKYL DI-IODO CHELIDAMIC ACIDS. Schering-Kahlbaum Akt.-Ges. Dec. 18, 1930. 372,245.

PROCESS FOR THE MANUFACTURE OF 3.5-DI-IODO-4-PYRIDONE. Schering-Kahlbaum Akt.-Ges. Feb. 11, 1931. 372,255.

METHOD OF TREATING CHLORATES FOR BLASTING PURPOSES. W. W. Triggs (*Finska Elektrokemiske Aktiebolaget*). Nov. 3, 1930. 372,281.

MANUFACTURE OF CARBON. Soc Carbonfix. Nov. 8, 1929. 372,336.

MANUFACTURE AND PRODUCTION OF ALKALI METAL CYANIDES. J. Y. Johnson (*I. G. Farbenindustrie*). Nov. 27, 1930. 372,306.

TREATMENT OF FIBROUS MATERIALS. J. Y. Johnson (*I.G. Farbenindustrie*). Nov. 27, 1930. 372,325.

COMPOSITIONS CONTAINING POLYMERISED VINYL COMPOUNDS, AND THE APPLICATION THEREOF. British Celanese, Ltd., and W. H. Moss. Dec. 24, 1930. 372,327.

MANUFACTURE OF AZO-DYESTUFFS. W. W. Groves (*I. G. Farbenindustrie*). Dec. 30, 1930. 372,338.

MEANS FOR REGULATING THE FLOW OF FLUID THROUGH A PIPE. Soc. Anon. Distribuzione Razionale Acque Potabili. Dec. 30, 1929. 372,286.

VULCANISATION OF RUBBER AND SIMILAR MATERIALS. L. Mellersh-Jackson (*Naugatuck Chemical Co.*) Jan. 2, 1931. 372,328.

MANUFACTURE AND PRODUCTION OF WETTING, CLEANSING AND DISPERSING, AGENTS. J. Y. Johnson (*I. G. Farbenindustrie*). Jan. 28, 1931. 372,389.

MANUFACTURE AND PRODUCTION OF LIQUID UNSATURATED HYDROCARBONS OF HIGH MOLECULAR WEIGHT. J. Y. Johnson (*I. G. Farbenindustrie*). Feb. 2, 1931. 372,321.

MANUFACTURE OF CELLULOSE XANTHATES. M. Michels and Soieries de Strasbourg Soc. Anon. Feb. 7, 1930. 372, 351.

MANUFACTURE OF WATER-IN-SOLUBLE AZO-DYESTUFFS, AND INTERMEDIATE PRODUCTS THEREFOR. A. Carpmael (*I. G. Farbenindustrie*). Feb. 3, 1931. 372,301.

FERTILISERS. Schering-Kahlbaum Akt.-Ges. Feb. 10, 1930. 372,354.

PROCESS FOR THE MANUFACTURE OF ISOCYANATES. A. Carpmael (*I. G. Farbenindustrie*). Feb. 4, 1931. 372,355.

MANUFACTURE OF ARTIFICIAL STABLE FIBRE. British Celanese, Ltd., and W. I. Taylor. Feb. 4, 1931. 372,323.

MANUFACTURE OF HYDROGEN. W. P. Rogers. Feb. 6, 1931. 372,366.

PURIFICATION OF PHENOL-CONTAINING LIQUORS. W. C. Holmes & Co., Ltd. (*Klär and Entphenolungsges*). Feb. 7, 1931. 372,399.

MANUFACTURE OF CELLULOSE AND THE LIKE. W. W. Triggs. (*L. Lemberger*). Feb. 14, 1931. 372,425.

SEPARATION OF ACETIC ANHYDRIDE AND ACETIC ACID. G. B. Ellis (*C. F. Boehringer and Soehne Ges.*) Feb. 17, 1931. 372,434.

PROCESS AND APPARATUS FOR THE CONTINUOUS RECTIFICATION OF ACETIC ACID. Soc. des etablissements Barbet. Mar. 31, 1930. 372,507.

MANUFACTURE OF COLOURED NITROCELLULOSE LACQUERS AND MASSES. W. W. Groves (*I. G. Farbenindustrie*). April 16, 1931. 372,525.

CONVERSION OF PARAFFINS OR OTHER SATURATED HYDROCARBONS INTO ETHYLENIC AND ACETYLENIC HYDROCARBONS AND INTO OTHER VALUABLE CHEMICAL PRODUCTS. Soc. des Carburants Synthetiques. May 21, 1930. 372,555.

PROCESS FOR THE MANUFACTURE OF AZO DYESTUFFS. I. G. Farbenindustrie. May 14, 1930. 372,562.

PROCESS FOR OBTAINING PURE ALUMINIUM-ALKALI DOUBLE FLUORIDES. H. A. Gill (*Saline Ludwigshalle*). May 27, 1931. 372,572.

Complete Specifications Open to Public Inspection

PROCESS FOR THE ALKYLATION OF ACID NITRILES. Dr. K. Ziegler. May 7, 1931. 7791/32.

MANUFACTURE OF PRINTING COLOURS. Dr. A. Wacker Ges fur Elektro-Chemische Industrie Ges. May 9, 1931. 10000/32.

PROCESS AND APPARATUS FOR THE MANUFACTURE OF METAL CATALYSTS. Schering-Kahlbaum Akt.-Ges. May 5, 1931. 12149/32.

COMPOUNDING OF LATEX AND COMPOUNDED LATEX. Boston Blacking Co., Ltd. May 8, 1931. 12203/32.

PROCESS FOR THE TREATMENT OF PRECIOUS METAL-CONTAINING MATERIALS. Deutsche Gold-und Silber-Scheideanstalt Vorm. Roessler. May 4, 1931. 12380/32.

MANUFACTURE OF SALTS OF AMINOACRIDINE COMPOUNDS. I. G. Farbenindustrie. May 4, 1931. 12866/32.

MANUFACTURE AND USE OF WETTING-OUT, EQUALISING, PEPTISING, AND CLEANSING AGENTS. Deutsche Hydrierwerke Akt.-Ges. May 4, 1931. 12887/32.

MANUFACTURE OF ETHER DERIVATIVES OF CARBOHYDRATES, PARTICULARLY CELLULOSE. C. F. Burgess Laboratories, Inc., Aug. 14, 1930. 12891/32.

MANUFACTURE OF CHLORINATED ARYLENETHIAZOLES. E. I. Du Pont de Nemours & Co. May 6, 1931. 13105/32.

FERTILISERS. Norsk Hydro-Elektrisk Kvaelstofaktieselskab. May 8, 1931. 13109/32.

PROCESS OF DYEING AND PRINTING. I. G. Farbenindustrie. May 8, 1931 13335/32.

PROCESS FOR INSPISSATING OR CONCENTRATING RUBBER LATEX. Metallges Akt.-Ges. May 9, 1931. 13378/32.

Applications for Patents

LIQUID-LEVEL INDICATORS. Ammonia Casale Soc. Anon., and S. G. S. Dicker. May 10, 13497.

PRODUCTION OF PRECIPITATED TITANIC OXIDE. A. N. C. Bennett, B. Laporte, Ltd., and I. E. Weber. May 12, 13719.

PRODUCTION OF COVERING LAYERS FROM CARBAMIDE-ALDEHYDE CONDENSATION PRODUCTS. A. G. Bloxam. (*Soc. of Chemical Industry in Basle*). May 12. 13718.

METHODS OF FORMING NON-BENZENOID HYDROCARBONS FROM ACETYLENE. E. I. Du Pont de Nemours & Co., and W. W. Triggs. May 11. 13560.

METHODS OF PREPARING HALOGEN-SUBSTITUTED BUTADINES. E. L. Du Pont de Nemours & Co. May 11. (United States, May 26, '31.) 13561.

MANUFACTURE OF AMINES OF THE BENZENE SERIES. E. I. Du Pont de Nemours & Co., and A. J. Wuertz. May 11. 13614.

DISCHARGE PASTES AND DISCHARGE PROCESSES. E. I. Du Pont de Nemours & Co. May 12. (United States, May 15, '31.) 13689.

MANUFACTURE OF YELLOW MORDANT DYESTUFFS. Durand and Huguenin Akt.-Ges., and W. W. Groves. May 12. 13720.

SODIUM HYDROSULPHIDE PREPARATIONS. W. W. Groves (*I. G. Farbenindustrie*). May 13. 13830.

TREATMENT OF HYDROCARBONS. P. Guichard. May 12. (France, Oct. 5, '31.) 13645.

MANUFACTURE OF PYRIDINE DERIVATIVES. H. J. Den Hertog, and J. P. Wibaut. May 12. (Holland, May 21, '31.) 13746.

CONDENSATION PRODUCTS AND COATING COMPOSITIONS. A. Hill, R. Hill, Imperial Chemical Industries, Ltd., and E. E. Walker. May 9. 13320.

CATALYSTS FOR DESTRUCTIVE HYDROGENATION OF CARBONACEOUS MATERIALS. L. Horton, and F. A. Williams. May 11. 13505.

IMPREGNATION OF POROUS MATERIALS. J. Y. Johnson (*I. G. Farbenindustrie*). May 12, 13696.

DYEING AND PRINTING. I. G. Farbenindustrie. May 9. (Germany, May 8, '31.) 13335.

PRODUCTION OF BERYLLIUM ALLOYS OF THE HEAVY METALS. I. G. Farbenindustrie. May 12. (Germany, May 28, '31.) 13739.

REACTION PRODUCTS OF KETONES, ETC. Naugatuck Chemical Co. May 12. (United States, May 16, '31.) 13704.

REFINING COPPER, ETC. Roessler and Hasslacher Chemical Co. May 9. (United States, May 9, '31.) 13321.

MANUFACTURE OF HYDROCYANIC ACID. Roessler and Hasslacher Chemical Co. May 12. (United States, May 14, '31.) 13690.

STABILISATION OF OILS AND FATS. Swift and Co. May 11. (United States, May 12, '31.) 13600.

DRYING DISINTEGRATED MATERIALS. Techno-Chemical Laboratories, Ltd., and N. Testrup. May 13. 13862.

MANUFACTURE OF ARTICLES OF FUSED SILICA WARE. Thermal Syndicate, Ltd. May 14. 13927.

PRODUCTION OF OXIDIC LAYERS ON ALUMINIUM, ETC. Vereinigte Aluminium-Werke Akt.-Ges. May 11. (Germany, May 26, '31.) 13618.

Sodium Sulphate Production in Belgium

SODIUM sulphate production capacity in Belgium is estimated at about 60,000 metric tons annually, but at present the output is approximately 40,000 tons. Present day consumption is about 36,000 tons compared with about 100,000 tons in 1913, the decline being attributed chiefly to substitution of soda ash for sodium sulphate in the manufacture of window glass. This estimate is based on domestic output of 40,000 tons plus 1930 and 1931 imports averaging 25,800 tons, less 1930 and 1931 exports averaging 30,000 tons.

Plastic Deformation of Metals

May Lecture of the Institute of Metals

PROFESSOR DR. F. KORBER, Director, Kaiser Wilhelm-Institut für Eisenforschung, Düsseldorf, delivered the twenty-second annual May lecture of the Institute of Metals in London on May 11, on "The Plastic Deformation of Metals." The results of the researches set out in the lecture undoubtedly constitutes a considerable enrichment of knowledge of the subject of metal working.

Basing his remarks on the results of a series of investigations which had been conducted at Düsseldorf during recent years, the lecturer dealt with the stress relationships and also with the course of the flow of the material which arose during the most important of the mechanical shaping processes. Discussions were entered into on the conditions requisite for the commencement of plastic flow and also on the possibility of drawing conclusions from the resulting flow phenomena as to the distribution of stress in the material at the inception of deformation. The disturbances in the material in consequence of the more marked deformations in drawing, extrusion and rolling were traced by a suitable method of investigation. The results were compared with the deformation structures obtained by X-ray methods. The knowledge of the deformation processes so obtained enabled conclusions to be drawn as to the energy or power used in the shaping operations. An exact analysis of the course of deformation in the transition zone lead to reliable estimates of the internal losses during the alterations in form. Quantitative treatment of the stress relationships which occurred in the zone of deformation, was possible in so far as the pressure created at the surfaces of contact between the tool and the material was known by actual measurefents. From the results of determinations along the roll gap of the pressure between the rolls and the stock being rolled, a complete quantitative presentation of the distribution of stress in the transition zone between the rolls has been formulated.

Rubber Information

A Reliable Commercial Compendium

THE 1932 edition of "Rubber Information" (Leonard Hill, Ltd., price 10s. net) is a compendium of the rubber industry in all its branches. The publication of this volume was originally undertaken in response to a general desire on the part of the industry for a comprehensive and up-to-date work of reference. It gives important facts and figures relating to plantation and factory practice, rubber chemistry, the rubber trade, machinery and equipment, planters, manufacturers and trade marks. Every effort has been made to arrange this variety of material in such a way that those who consult the book can find what they want with the least trouble, and every effort has also been made to ensure the accuracy of the data given. The volume is edited by Dr. H. B. Cronshaw, who, in compilation, has been assisted by F. H. Cotton, H. A. Daynes, T. J. Drakeley, J. R. Scott, H. P. Stevens, W. H. Stevens, and S. Howard Withey. The section dealing with compounding ingredients lists about one thousand rubber chemicals concerning which full and up-to-date particulars are given as to their composition, trade names, suppliers, properties, uses, etc. In the section dealing with the technicalities of rubber growing, manufacture and the production of various rubber goods, one finds a veritable mine of information arranged under alphabetical headings for quick and convenient reference. Prominent authorities in the industry have contributed to the compilation of this section, and it contains more facts and useful data than have ever before been published within the space of seventy pages. Another features of inestimable value to the business man is the classified index of manufacturers and suppliers of raw materials, products, plant and equipment, which are likewise arranged in alphabetical order. Commercial information concerning several hundred rubber growing companies is to be found in another section, particulars of the year's crop, acreage, annual dividend and capital being recorded. There is also a bibliography of technical books relating to the rubber and other industries.

Publications Received

The Editor welcomes copies of new brochures and leaflets describing plant, equipment and products of interest to chemical manufacturers and the chemical using trades.

ENGINEER-BUILT trailers are featured in the May issue of "Sentinel Transport News," the trade organ of the "Sentinel" Waggon Works, Ltd. By hauling a trailer behind a "Sentinel" four-wheeler on pneumatics, the maximum gross weight allowed by law is increased from 13 tons to 22 tons. Thus for an extra tax of only £6 per annum, the pay-load may be increased by about 6 tons. This means that the legal pay-load of a four wheeled "Sentinel" and its trailer will be some 12 to 13 tons. Such an outfit is therefore very economical because for a small additional expenditure on fuel and slightly increased depreciation charges an extra pay-load, almost equal to that on the waggon itself, can be transported. These "Sentinel" trailers are machines of modern design and construction built from accurately machined and interchangeable parts produced by the same machinery as are those for "Sentinel" waggons. They range in size from six to ten ton capacity, with fixed or tipping bodies as may be required. Besides the ordinary standard body with sides, they can be fitted with flat platform sideless bodies, van bodies, or bodies with high tail boards.

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CONTROLLING, RECORDING AND INDICATING INSTRUMENTS of all types are illustrated in Bulletin No. 174 of the Foxboro Co., of Massachusetts, who are represented in England by Walker, Crosweller and Co., Ltd., 20 Queen Elizabeth Street, London, S.E.1. Among the instruments described are draught gauges for power plant, to show whenever excess air is present and where it is coming from; liquid level gauges to cover ranges up to the pressure equivalent of 150 lb. per sq. in.; indicating and recording thermometers; boiler water level recorders operating on the mercury U-tube principle and giving a direct measurement (in inches) of the water level whether the boiler is in operation or not; liquid flow meters, which are now available for service on pressures up to 2,500 lb. per sq. in.; steam flow meters, made in a number of standard ranges which easily cover every commercial need; gas meters; non-recording controllers, for cases where a record of control operation is not considered of sufficient importance to warrant the additional expenditure; temperature recorder controllers; recording psychrometers for humidity; flow controllers and ratio-flow controllers. The latter are used in cases where it is desired to control the flow of one liquid in definite ratio to that of another liquid, as in the case of gasoline absorption plant, where it is necessary to maintain the proper ratio of lean oil to wet gas entering the absorber, and to maintain the proper ratio of steam to fat oil entering the still.

* * *

SILVER AND ITS APPLICATION TO CHEMICAL PLANT is dealt with in a brochure issued by Johnson, Matthey and Co., Ltd., 73-82 Hatton Garden, London, E.C.1. This brochure is really a summary of a paper read before the Chemical Engineering Group in February, 1931, and is of especial interest to users of silver plant in view of the data given relating to the action of various chemical liquors upon the metal. The most extensive application to chemical plant evident so far is in the condensation and general handling of acetic acid, which is particularly corrosive at the moment of condensation. This may be due to the co-operative action of finely divided acid and oxygen, and has given very great trouble to manufacturers who usually use copper condensers. Many of these have now been abandoned in favour of silver, with entirely satisfactory results. Some of these are large pieces of plant weighing several hundredweights, and are of both the tubular and the coil types, the tubes being welded or, if not too large, seamless solid drawn. The heat transmission is excellent, and, on account of its superior thermal properties, a silver condenser can be considerably smaller than a copper one designed to do the same work. Since silver possesses a low specific heat, a fairly high coefficient of expansion and high thermal conductivity, the apparatus will expand rapidly on the application of heat, and in some cases special arrangements must be made to allow this to take place without giving rise to buckling.

Alcohol from Sawdust

The Scholler-Tornesch Process in Germany

THE Scholler-Tornesch process for utilising wood cellulose as a raw material for alcohol manufacture has been operated upon a commercial scale since the latter part of 1931 at the alcohol plant of the Brennerei und Presshefe-Fabrik Tornesch G.m.b.H., Tornesch, Holstein. A subsidiary corporation, the Deutsche Holzverzuckerungs und Chemische Fabrik, A.G., was recently formed to acquire the patents and rights to the invention.

The Tornesch plant has in operation three digesters with a capacity of 6 metric tons of sawdust each. Two additional digesters with a capacity of 12 tons are now being erected. The Scholler process is being continuously operated, on a basis of three 8-hour shifts, and employs 26 workmen at the present time. While any kind of wood or cellulose material such as maize, or rice hulls may be employed, the present commercial working of the Scholler process is based upon the use of cheap waste materials from lumber mills, such as sawdust, shavings and wood chips. Various species of woods give different yields, the common German "kiefer" (pine) waste now being used. One hundred kilos of dry wood is said to produce 60 kilos of glucose, the conversion requiring from 8 to 10 hours.

Certain advantages are claimed for the new process over previous methods for manufacturing glucose from wood. Previous processes, it is asserted, utilised dilute acids with a maximum yield of 9 litres per 100 kilograms of wood which Dr. Scholler states is commercially unprofitable. Processes employing concentrated acids had to recover these substances for which purpose expensive apparatus was necessary. The Scholler-Tornesch method is said to require only one part per thousand of hydrochloric or sulphuric acid which is not necessarily recovered and the use of ordinary iron digesters further reduces costs. It is essential, however, to have the plant erected near the source of waste material.

Products of the Process

The products obtained from 100 kilograms of dried wood by the Scholler-Tornesch process comprise usable glucose (40 kilos), waste glucose (20 kilos), lignin (33 kilos), weak acetic acid (4 kilos), furfurol (1 kilo), ethyl di-bromide (0.2 kilo), unknown (1.8 kilo). The present production costs of the Brennerei und Presshefe-Fabrik Tornesch are stated to be 0.11 marks per litre, based on a 25 litres production from 100 kilos of wood. Wood costs at Tornesch amount to 17 marks per metric ton or 0.07 marks a litre for raw material, making a total cost of 0.18 marks per litre. In actual practice, costs have varied from a minimum of 0.14 marks to a maximum of 0.18 marks per litre.

The estimated cost of erecting an entirely new plant capable of turning out 35,000 hectolitres of alcohol annually would amount in Germany to about 900,000 marks. The actual cost of the Tornesch plant was only 300,000 marks as the equipment for converting the glucose into alcohol was already available.

Oxidation of Aldose Sugar

Use of Bromine Water

THE oxidation of the aldose sugars to monobasic acids by bromine water is one of the classical reactions which has been considered as evidence for the aldehydic structure for glucose and related sugars. In a recent investigation at the United States Bureau of Standards bromine oxidations of various sugars were followed by the optical rotations of the solutions. A series of remarkable changes was found from which it was concluded that the sugars are not oxidised to the sugar acids as previously believed. The delta lactones are the first products which can be detected by means of the optical rotations. The acids which appear subsequently are secondary products resulting from the hydrolysis of these lactones. If the fact that the lactone formation precedes the formation of gluconic acid is interpreted to indicate that one ring form of the sugar is oxidised directly to the lactone, it cannot be said whether or not the particular form of the sugar which is oxidised is the predominating form in solution. A complete report of this study appears in the March number of the *Bureau of Standards Journal of Research*.

Chemical Matters in Parliament

Chemical Warfare

IN the House of Commons on May 11, Mr. Rhys Davies (Lancaster, Westhoughton), asked the Financial Secretary to the War Office whether any Government subsidy is being paid for any experiments with poison gas carried out at universities or other educational institutions.

Mr. A. DUFF COOPER replied that certain scientists at the Universities of Oxford, Cambridge and London carry out experiments on chemical defence problems, for which payment is made to them from Army funds.

Utilisation of Wood Flour

Some of Its Main Applications

A STUDY by H. H. Steidle, of the American Committee for Wood Utilisation, gives some indications of the production and uses of wood flour ("Les Matières Grasses," 1932, p. 9476.) Wood flour is prepared in the United States and Europe mainly from pine and spruce wood. Other woods can be used provided they have no characteristic colour nor contain an excessive amount of resin. The manufacture consists in grinding the wood in the old form of flat stone mill enclosed in a suitable casing, overheating being prevented by the introduction of small amounts of steam. After sieving, the powder is further finely ground to a flour, air separated and packed. It is mentioned that the American linoleum industry uses annually about 20,000,000 lb. of wood flour, being incorporated as a filler with the resin and oil. The fine state of division of the meal allows of the production of a highly polished finish to the linoleum. With a less fine, but more fibrous meal, rather characteristic of American products, the tenacity of the floor covering is increased. Another use to which wood flour is put is as a filler for bakelite articles. It is also valued as a constituent of explosives, as it considerably reduces the sensibility to shock of nitro-glycerine. A composition for a normal 40 per cent. dynamite is:—nitro-glycerine 40 per cent., sodium nitrate 44 per cent., calcium carbonate 1 per cent. and wood flour 15 per cent. Such a product can be transported by ordinary means. At the same time, evolving gases on combustion, it increases the explosive power of the dynamite.

Foreign Trade Essential

Manchester and the Ottawa Conference

THE Board of Directors of the Manchester Chamber of Commerce passed a resolution on Monday, May 9, indicating in general terms the basis of the policy they advocated for the Ottawa Conference. This resolution expressed the hope that arrangements would be completed which would cement and increase trade within the Empire on a basis mutually advantageous to all parts of the Empire, and continued:—

"The Board condemns as highly inimical to the best interests of Great Britain the tendency in some quarters to regard the Ottawa Conference as a purely anti-foreign movement. Foreign trade is necessary to Great Britain and also to other parts of the Empire. The arrangements made at Ottawa should be such as will afford every opportunity for foreign countries who will deal on a satisfactory basis with Great Britain or the Empire to be allowed and encouraged to do so. The aim of the conference should not be the exclusion of foreign trade but the stimulation of inter-Empire trade by arrangements which will increase the fundamental economic strength and well-being of the Empire countries."

Chemical Society Research Fund

APPLICATIONS for grants from the Research Fund of the Chemical Society must be made by June 1 on a special form obtainable from the Assistant Secretary, Chemical Society, Burlington House, W.1. Attention is directed to the fact that the income derived from the donation of the Goldsmiths Company is more or less especially devoted to research in inorganic and metallurgical chemistry, and that from the Perkin Memorial Fund to investigations relating to problems connected with the coal-tar and allied industries.

From Week to Week

MR. R. S. HAYES, Porthcawl, has purchased the Black Mountain Silica Works, Swansea Valley. These quarries were closed down about three months ago.

ABOUT THIRTY GALLONS OF AMMONIA escaped last week from a tank at the premises of Millan Brothers, 87 Gallowgate, Glasgow, and an employee was overcome with the fumes and had to be treated at the infirmary.

A SECOND MAN, Charles William Bolton, aged 52, of Coburg Street, Darlington, died on May 16 from injuries sustained in an oxygen plant explosion at the Darlington Forge, Darlington, on May 2.

MR. ARTHUR EDWARD BARCLAY, of Blackheath, a director of Barclay and Sons, Ltd., druggists' sundriesmen, Farringdon Street, E.C., who died on April 7, in his 79th year, left £8,425, with net personalty £7,718.

MR. JOSEPH F. MORGAN, manager of the dry-cleaning department of J. Pullar and Sons, dyers and cleaners, Perth, has retired after 42 years' service with the firm. To mark his retirement he has been presented with a smoker's outfit.

A SERIOUS FIRE broke out at the premises of Barclay and Sons, Ltd., druggists' sundriesmen, Farringdon Street, London, on Saturday, May 14. Fire towers were used in order to fight the flames, and a considerable part of the building was destroyed.

IN THE ABSENCE OF A PROPOSER, a resolution on the agenda at the recent annual meeting of the Chemical Workers' Union calling upon the national executive council to make special efforts to organise the coking and by-products industry of Great Britain was withdrawn.

SCOTTISH OILS, LTD., have decided to dismantle another two of the oil works in West Lothian which were shut down in July. Seafield had a full retorting plant and was used for the manufacture of crude oil; the oil works and the plant at the shale mines at Philipstoun are also to be dismantled.

HENRY JORDON, aged 62, of Tunstall, who was injured in an accident while following his employment at the Birchenwood Chemical Works, Kidsgrove, on Monday, succumbed to his injuries later the same day. Jordon, it is stated, received internal injuries when he was hit by a plate which flew off a machine.

DR. E. F. ARMSTRONG, a past-president and hon. foreign secretary of the Society of Chemical Industry, will sail for Canada on July 2 to represent the chemical industry at the forthcoming Imperial Conference at Ottawa. He will be accompanied by Mr. J. Davidson Pratt, general manager and secretary of the Association of British Chemical Manufacturers.

PROFESSOR R. V. WHEELER states that he is in no way concerned with the commercial exploitation of the Salerni low-temperature carbonisation process. He has given advice and assistance in the technical development of this process, such as, in his position as professor of fuel technology at Sheffield University, he gives in any other coal industry problem, but he is not concerned commercially in this particular process.

RESEARCH ON THE DEVELOPMENT of the use of peat, of which large deposits exist in the Irish Free State, is at present being carried on in Ireland. It is understood that the main work is in the search for an efficient illuminant, gas and paraffin having both been produced from peat, and also in the use of peat as a material for woven fabrics. There are five large firms interested in the working of the peat in the Irish Free State, their headquarters being at Ferbane, Edenderry, Tullamore, Monasterevan and Enfield. Peat is, of course, used extensively as a fuel in the country districts of Ireland, but the price in Dublin is about 40s. per ton.

A NEW ARRIVAL among publications by Manchester societies is the University Chemical Society's magazine. Its object is two-fold—to reflect something of the life and spirit of the department and to keep alive the interest of all past students in the Chemistry School. The leading article points out that it has always been the unfortunate lot of the newer universities to lose touch with their past students; this is a conscious attempt to maintain among former members of the Chemistry School "that spirit of unity of which they were conscious during their student days." Dr. F. S. Spring edits the new magazine, which has the blessing of Professor A. Lapworth, who occupies the Chair of Chemistry of Manchester University.

THE BRITISH STANDARDS INSTITUTION has issued a British standard specification for the use of structural steel in building. The issue of this specification is of much importance to the building industry in formulating a standard upon which practice may be based in accordance with the most modern developments in the application of steelwork. The specification is based upon the work carried out by the Steel Structures Research Committee of the Department of Scientific and Industrial Research and by the British Steelwork Association on behalf of the steel and structural engineering industries. The results of this research are now made available in the form of the British standard specification, the use of which will permit increased efficiency in building construction.

THE NAME of the National Union of Drug and Chemical Workers has been changed to "The Chemical Workers' Union (incorporating the National Union of Drug and Chemical Workers and National Association of Chemists' Assistants)."

THE SUMMER EVENING CLASSES at the Manchester Municipal College of Technology commence on Monday, May 30. A prospectus of short courses of lectures and laboratory work to be given during the session can be obtained on application to the Registrar.

THE FRIENDS OF ECONOMY will hold a second City of London Economy Demonstration at the Cannon Street Hotel on Thursday next, May 26, at 2.15 p.m., when the speakers will be Sir Robert Horne, Sir Eric Geddes and Sir Ernest Benn. Mr. E. C. Grenfell, M.P., will preside.

MR. A. B. WINDER, general manager and a director of Industrial Steels, Ltd., has been appointed works director of English Steel Corporation, Ltd. Mr. A. Dunbar, commercial manager of the Elswick works of Vickers-Armstrongs, Ltd., has been appointed commercial manager of English Steel Corporation, Ltd.

TWENTY-FIVE TONS OF MOLTEN GLASS poured out of an oil and compressed air oven at Turnbull's glassworks, Sunderland, when the oven burst last week. Martin Shaw, in face of great danger, turned off the oil feeding the oven, and prevented the fire from becoming more serious. The shed in which the oven was situated was partly destroyed.

RECENT WILLS include:—George Henry Wood, of 164 Bramhall Lane, Davenport, Stockport, manufacturing chemist, who died on November 29 last, £110,936 (net personalty £97,883); Arthur Lucas Chance, of Great Alne Hall, Alcester, Warwick, for many years associated with Chance Brothers and Co., Ltd., glass manufacturers, of Smethwick, unsettled estate £73,495 (net personalty £63,899).

A NORTHWICH INDUSTRIAL DEVELOPMENT COMMITTEE has been formed of members of the urban and rural councils and representatives of the Imperial Chemical Industries, the Salt Union, Ltd., the Chamber of Trade, and Mid-Cheshire Electricity Company and the Cheshire Lines Committee. There are now over 4,000 unemployed in mid-Cheshire, and it is felt that, apart from the economic situation, the introduction of mechanical means of production in works means that the chemical industry will never absorb the same amount of labour. The committee have therefore decided on a big advertising scheme to attract new industries.

THE IMPORT DUTIES ADVISORY COMMITTEE is considering applications made under Section 1 (3) of the Import Duties Act, 1932, for the addition to the free list of various articles, including glycol ethers and glycol ether esters, bromine, boron minerals imported in a crude state, white arsenic, and natural but not terpeneless oils (aniseed, bois de rose, brown camphor, bergamot, citronelle, geranium, lavender, lemond and peppermint). Any representations concerning these applications should be addressed in writing to the Secretary, Import Duties Advisory Committee, Caxton House (West Block), Tothill Street, London, S.W.1, not later than June 2.

Obituary

MR. JOHN ADAMS HATFIELD, analytical chemist, of Royston, Gartcosh, at Glasgow, May 14.

MR. J. G. STEVENS, secretary of the Chemical Section of the Huddersfield Workers' Union, on May 5, aged 51. Mr. Stevens was a director and past-president of the Huddersfield Friendly and Trades Club.

MR. R. G. ROSS, London representative of Dexine, Ltd., of Stratford, suddenly on May 9. Mr. Ross's duties have been taken over by Mr. H. Butcher, who has been with the company for a considerable time.

LORD EBURY, aged 48, in a London nursing home on May 15, following a hunting accident in March last. After leaving Harrow in 1899, Lord Ebury studied mining engineering and metallurgical chemistry at the Camborne School of Mines and under Benedict Kitto in London. After working as a labourer and pitman in mines in the Isle of Man, he went to Canada in 1903, and was employed as metallurgical chemist by the Canadian Pacific Railway Company in British Columbia. He then removed to Nelson, British Columbia, as chief chemist to the Hall Mines. Afterwards, in 1910, as a land expert, he reported on various land grants for a London firm, and in 1911 became assistant managing director of the Norton Griffiths contracting firm in Western Canada. In 1912 he was employed by the late Duke of Sutherland to organise an Imperial immigration scheme in Canada, and was managing director of the Norton Griffiths interests in British Columbia from December, 1912, till the outbreak of the war. At his death he was chairman of the Army and Navy Stores, and a director of the Union Bank of Australia and the West End Board of the Royal Exchange Assurance Company. He had been a director of the Hudson's Bay Company. He was president of the London Employers' Association.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

Mortgages and Charges

[NOTE.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]

CHESHIRE UNITED SALT CO., LTD., London, E.C. (M., 21/5/32.) Registered May 5, series of £35,000 (not ex.) debentures, present issue £11,500; general charge (subject &c.). *£4,500 mortgages and £4,525 secured notes. Oct. 23, 1931.

Satisfactions

SPLINTEX SAFETY GLASS, LTD., London, S.W. (M.S., 21/5/32.) Satisfaction registered May 4, £3,000, part of amount registered November 27, 1930.

YEAST PRODUCTS, LTD., London, W. (M.S. 21/5/32.) Satisfaction registered May 4, all moneys, etc., registered May 8, 1931.

Companies Winding Up Voluntarily

ANGLO-CONTINENTAL GRAPE PRODUCTS, LTD. (C.W.U.V, 21/5/32.) By special resolution May 9. Fredk. C. T. Lane, 2 Norfolk Street, Strand, W.C.2, and Thomas Alfred Ryder, 4 and 6 Throgmorton Avenue, E.C.2, appointed joint liquidators. Creditors' claims to the liquidators by June 15.

BRITISH PETROLEUM CO., LTD. (C.W.U.V., 21/5/32.) By special resolution May 12. Mr. Charles Edward Stroud, Britannic House, Moorgate, London, E.C.2, appointed liquidator. Creditors' claims to the liquidator by June 18.

New Companies Registered

G. H. Gregory, Sons and Partners, Ltd., 59 Gracechurch Street, London, E.C.3. Registered April 27. Nominal capital, £5,000 in 9,000 preference shares of 10s. each and 10,000 ordinary shares of 1s. each. Moulders in bakelite, cellulose, celluloid, vulcanite, casein, acetate, formaldehyde or other compounds and other plastic and thermo plastic powders; chemical manufacturers and dealers, etc. Directors: E. C. Powell, H. N. Pickford.

Hayfield Chemical Co., Ltd.—Registered May 13. Nominal capital £500 in £1 shares. To acquire certain chemical formulae, to adopt an agreement with B. V. Lynch and P. E. L. Crawshaw, and to carry on the business of manufacturers of and dealers in chemicals, gases, drugs, medicines, etc. Directors: O. L. Spedding, Holly Grove, Dobcross, Yorks; B. V. Lynch, P. E. L. Crawshaw.

Industrial Colloids, Ltd., 312 Deansgate, Manchester. Registered April 29. Nominal capital £100 in £1 shares. Chemical manufacturers, analytical and manufacturing chemists, soap manufacturers, importers of, agents for and dealers in medicinal and industrial chemical preparations, oils, fats, waxes, greases and soaps, etc.

Thawpit Developments, Ltd., Astor House, Aldwych, London, W.C.2.—Registered May 9. Nominal capital £12,000 in 6,000 ordinary and 6,000 6 per cent. cumulative participating preference shares of £1 each. The objects are to adopt an agreement, dated March 31, 1932, between J. Foster and S. W. Beeman of the one part, and T. E. Thorpe, E. Q. Carter and C. W. Grover of the other part, for the exploitation of a certain invention entitled "improvements in or relative to Rotary Dry Cleaning and Washing Machines." merchants and distributors of patent medicines, patent cleansers, soap, cleaning materials, etc.

Company News

American Potash and Chemical Corporation.—For the year 1931 a net income of $1,463,145 is reported.

Drug Incorporated.—The regular quarterly dividend of one dollar per share is announced payable on June 1.

Middle German Nitrogen Works.—A dividend of 6 per cent. is announced for the year 1931, against 7 per cent. for 1930.

Bavarian Nitrogen Works.—No dividend is to be paid for the year 1931. In the previous year 7 per cent. was distributed.

Eastman Kodak Co. of New Jersey.—The regular dividend of $1.25 per share has been declared payable on the common stock.

British Oil and Guano.—A debit balance of £197 is reported to be carried forward for the year ended March 31 last. No dividend is to be paid.

Nitrate Railways Co., Ltd.—The directors announce that no dividend will be paid on the 7 per cent. preferred convertible ordinary shares of £10 each in respect of the year 1931.

British Cotton and Wool Dyers' Association.—A net profit of £35,175 is reported for the past year, and a dividend of 3½ per cent. is to be paid. No dividend was paid in the previous year.

Tate and Lyle, Ltd.—The directors announce an interim dividend of 4 per cent., less tax, on the ordinary shares, payable on June 15, which is the same as was paid for the corresponding period last year.

Chloride Electrical Storage Co.—A final dividend of 5 per cent., free of tax, is recommended on the "A" and "B" ordinary shares, making 10 per cent., free of tax, for the year to March 31 last. The annual meeting will be held at Clifton Junction, near Manchester, on May 27, at 11 a.m.

National Drug and Chemical of Canada Co.—The profit and loss account for the year to January 31 last, shows a balance brought forward of £93,796, and a revenue for the year of £5,239, making £99,035. From this is deducted £4,088 reserved for depreciation, leaving to be carried forward £94,947.

International Nickel Co. of Canada, Ltd.—The report for the first quarter of 1932 shows a net profit of $536,071.07. This is stated to be more than sufficient to cover preferred dividend requirements of $483,485.19, and compares with a net profit of $1,650,637.52 reported for the corresponding qaurter of 1931. The cash position was slightly strengthened, showing a total of $3,452,050.15 in cash, demand loans and government securities against $3,112,019.98 at the end of the previous quarter. Inventories were substantially the same at $21,650,869.

United Premier Oil and Cake Co.—The revenue account for the year 1931 shows a credit balance of £81,756, compared with £18,854 for the preceding year. It is reported that no subsidiary company has worked at a loss, and the deficiency of £17,489 in certain subsidiary companies, which was carried over from last year, has been made good during this period. After deducting interest on debenture stock for the year, dividend on preference shares for the half-year to December 31, 1930, there remains £45,183. To this is added the amount brought forward 8,194, making £53,377. After deducting dividend on preference shares to June 30, 1931, and dividend on preference shares for the half year to December 31, 1931, the balance to be carried forward is £18,046. The annual meeting will be held at Winchester House, London, E.C., on May 25, at 2.45 p.m.

Tariff Changes

Palestine.—A Customs Tariff (Amendment) Ordinance, No. 3 of 1932, which became effective on April 15, increases the Palestine Customs duties on kerosene in tins or drums not exceeding 18.2 litres (4 gallons)—from 27 to 32 mils. each; in other containers or in bulk from 1.50 to 1.75 mils per litre.

Palestine.—An Order, dated April 7, requires a licence for the import into Palestine of all acid and offal oils, except those imported from Syria under the terms of the Palestine-Syria Customs Agreement.

Chemical Trade Inquiries

Abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

British West Indies.—A firm of commission merchants at Trinidad desires to obtain representation for Trinidad, Barbadoes and British Guiana, of a United Kingdom producer of whale oil for the manufacture of soap. (Ref. No. 862.)

Canada.—A manufacturers' agent at Toronto wishes to represent United Kingdom manufacturers of refractories, high grade bituminous paints and fertiliser machinery, for the province of Ontario. (Ref. No. 864.)

Italy.—An agent established at Naples wishes to obtain the representation of United Kingdom firms for the South of Italy only, for gum, etc. (Ref. No. 875.)

Egypt.—A firm of general agents and import merchants established at Cairo wishes to represent United Kingdom manufacturers of bone glue, etc. (Ref. No. 882.)

Forthcoming Events

May 24 and 25.—Society of Glass Technology. Tuesday—Council Meeting. 4.30 p.m. Ordinary General Meeting, 7.30 p.m. Science Museum, London. Wednesday—Ordinary General Meeting (Session II), Science Museum. Annual Dinner and Dance. 7.15 p.m. Trocadero Restaurant, London.

May 25.—British Chemical and Dyestuffs Traders' Association, Ltd. Annual General Meeting. Trade Luncheon at Howard Hotel, Norfolk Street, Strand, London.

May 25.—British Science Guild. A Popoular Lecture on "Polar Lights." Professor Sydney Chapman. 5 p.m. Royal Society of Arts, John Street, Adelphi, London.

May 27.—Royal Institution. "New Conceptions of Medical Research." Sir Walter Morley Fletcher, 9 p.m. 21 Albemarle Street, London.